FEB 18 1916

THE HEATING AND VENTILATING MAGAZINE

Vol. XIII. No. 2.
$1.00 a year. 10 cents a copy.

NEW YORK, FEBRUARY, 1916.

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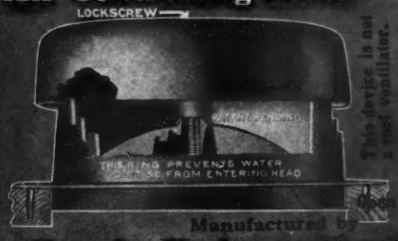

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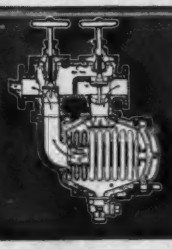

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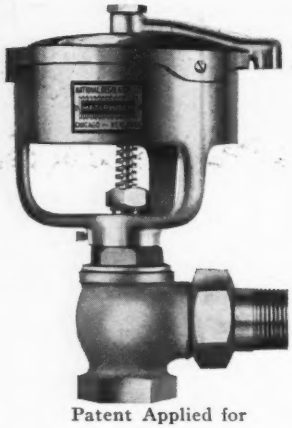

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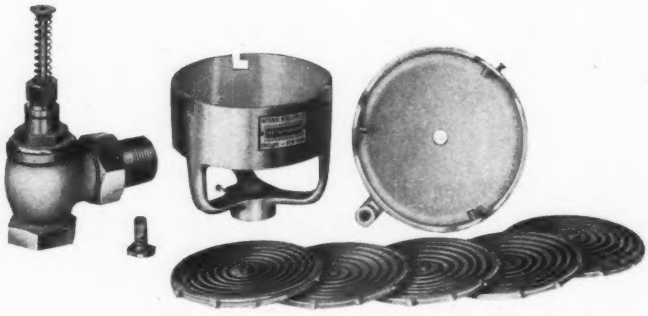

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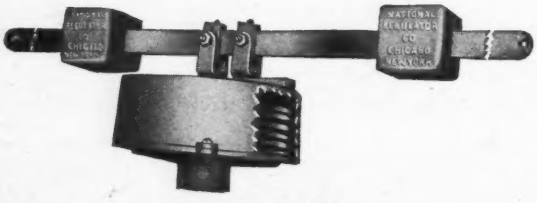

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THE HEATING AND VENTILATING MAGAZINE

1123 BROADWAY NEW YORK FEBRUARY, 1916

The Principle of Bernoulli and its Relation to Heating and Ventilating of a Building

By S. R. WILLIAMS.

Let us suppose that water is flowing through a water main from a standpipe whose head is maintained at a fixed value. The water as it flows through the pipe is said to have a steady state of flow. The same state could also be said to exist if at some point in the pipe a constriction occurred. When in a fluid, either a liquid or a gas, we have a steady state of flow, the principle of Bernoulli states that the total energy per unit volume at one point in the stream must be the same as at some other point. In the case of water flowing through a pipe with a constriction in it we know that if the pipe does not have some branch opening or leak in it that the quantity of water which flows past one section of the pipe will be the same as at some other section.

This means that the velocity of flow in the pipe at a point of contraction must be greater than at some other point or that the kinetic energy is greater at a point of constriction than elsewhere. If this be true then from the law of the conservation of energy the potential energy must be smaller at a constriction than elsewhere in the pipe.

The expression for the kinetic energy of a unit volume of water in motion, of mass m and velocity v, is $\frac{1}{2}mv^2$, while for the potential energy per unit volume it may be shown that it is equivalent to the pressure, p, under which the liquid finds itself. Bernoulli's principle is another way of stating the law of conservation of energy; viz., that the sum of the potential and kinetic energies of a unit volume of a fluid at one point in a steady flow must be equal to the sum of these two energies for a unit volume at some other point.

We may express this condition by an equation thus:

$$p_1 + \tfrac{1}{2}mv_1 = p_2 + \tfrac{1}{2}mv_2 \quad \ldots\ldots\ldots (1)$$

where the subscripts indicate two different points, 1 and 2, in the steady state of flow. Applying this equation to the water pipe with a constriction in it, let 2, Fig. 1, represent a point of contraction in the pipe and 1 any other point where the pipe is of regular size. It has just been pointed out that v_2 must be greater than v_1, and since the mass is constant, p_2 must be smaller than p_1.

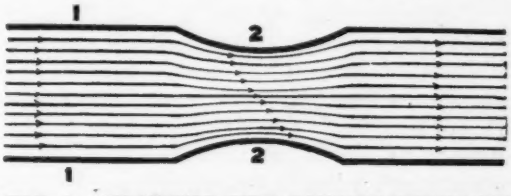

FIG. 1.—SHOWING THE CONVERGENCE OF STREAM-LINES OF FLOW IN A PIPE WHICH HAS A CONSTRICTION.

PRINCIPLE HOLDS FOR EITHER LIQUID OR GAS.

If equation (1) is to hold; i. e., at a point of contraction in a water pipe the pressure is less than at some other point.

This line of reasoning holds for either a liquid or a gas and the principle has a very wide application.

This difference in pressure for two points such as 2 and 1 in Fig. 1 is made use of in the Venturi water and gas meters. A pipe, A-B, Fig. 2, has a contraction drawn in it and at points 2 and 1 in this pipe, side tubes are introduced

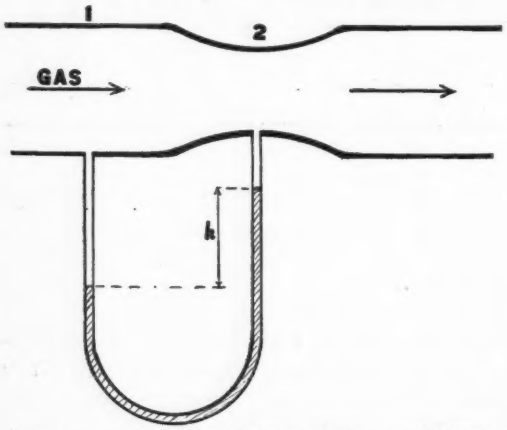

FIG. 2.—ILLUSTRATING THE PRINCIPLE OF THE VENTURI METER.

as shown in the illustration, to which a U tube is attached. If a quantity of some liquid is placed in the U tube and gas allowed to flow through the pipe A-B, then the liquid in the U tube will stand in the arm attached at the point 2 to a greater height than in the other arm and this difference, h, in height is a measure of the quantity of gas flowing through A-B.

PRINCIPLE ILLUSTRATED BY ACTION OF BOATS IN RUNNING WATER.

Equation (1), which is a short hand statement of Bernoulli's principle, may be illustrated in another way. Picture, as shown in Fig. 3, two boats anchored rather near each other in mid-stream. The water, as it flows past the two boats, encounters what is practically a contraction of the stream-lines of flow and since, as has been shown, the pressure is least where the velocity is greatest there will be a difference in pressure exerted on the two sides of either boat which will be so directed as to cause the two boats to swing together. This may be very easily observed with two row boats. The same effect is present whether the boats are still and the water running or the two boats are drawn over still water.

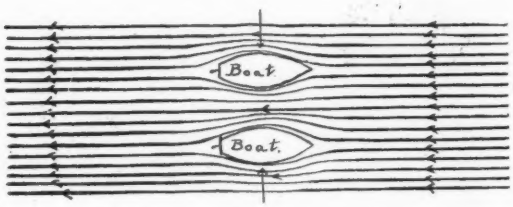

FIG. 3.—REPRESENTING THE FORCES TENDING TO SWING THE BOATS TOGETHER.

EFFECT OF WIND BLOWING PAST HOUSES.

In a similar way we may think of two houses past which the wind is blowing. See Fig. 4. The stream-lines of flow converge between the two houses and there is, by the principle of Bernoulli, a tendency for the two houses to move toward each other. Inasmuch as the houses are fixed, no such result occurs, but the air in the houses has this tendency and we have the continuous phenomenon of the houses being exhausted in just the way an aspirator works. This means that not only, due to the pressure of the wind on the windward side of the house, is the air inside of the house being driven out on the other sides, but the air is also being pulled out on the sides of the house past which the air is flowing.

DEMONSTRATION WITH SHEET OF PAPER.

This may be illustrated by the following simple demonstration. Hold a long sheet of writing paper by the corners of one end and allow the other end to hang down. If one blows directly over the top of the sheet at the end which is held as shown in Fig. 5, the free end will be

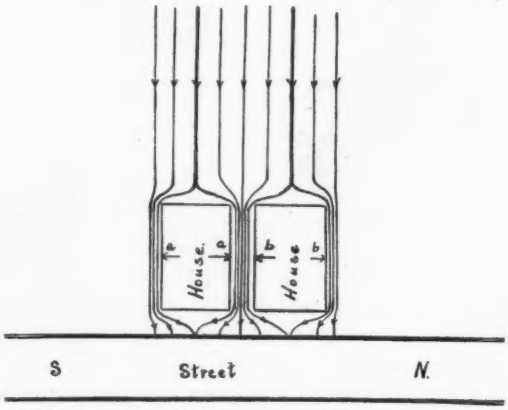

FIG. 4.—THE ARROWS a AND b INDICATE DIRECTIONS IN WHICH AIR IS DRAWN FROM HOUSE AS THE WIND BLOWS PAST.

lifted, due to the difference in pressure created according to the theorem of Bernoulli. In just the same way the side of a house tends to come out when the wind

FIG. 5.—AIR BLOWN OVER A SHEET OF PAPER WILL PRODUCE DIFFERENCES IN PRESSURE WHICH WILL HOLD PAPER OUT HORIZONTAL FROM THE LIPS.

blows along it, but since it is rigid, the air inside comes out through every accessible crack and opening. This means a forced ventilation which is not altogether desirable when a cold wind is blowing about the house.

A HEATING SYSTEM THAT WORKED BACKWARDS.

The writer lives in a region where the winds prevail from the southwest to such an extent that the trees have a decided lean toward the northeast. For four years he lived on the west side of town where the wind has full sweep at the houses, which were built along the west side of a north and south street (see Fig. 4) and the operation of Bernoulli's principle was very frequently noticed. For a house heated by steam or hot water a ventilation of this sort was not so bad, but in the house in which he lived there was a hot air furnace whose cold air inlet was on the south side of the house and close to the adjoining house. As the prevailing southwest winds swept down between the houses, the principle of Bernoulli operated to such an extent that the hot air furnace worked backwards. After a month of vain endeavor to heat the house on windy days the author discovered a group of English sparrows sitting in the cold air shaft and enjoying the heat as it poured out, which gave him the clue as to why the interior of the house did not warm up.

On looking up the matter more carefully it was found that those who install hot air furnaces in this locality have never taken this matter into consideration. Indeed they seem to prefer to put the cold air inlet where it will be the most ineffective and there are many complaints about the difficulties of keeping the houses warm when the inlet is thus installed. In the house just mentioned this difficulty was overcome by extending the cold air shaft with inlet to the west side of the house and putting in a large control damper.

These observations are written in the hope of calling the attention of those who install our heating and ventilating outfits to the very large influence this phenomenon of Bernoulli has upon the heating and ventilating of buildings.

Effect of Velocity and Humidity of Air on Heat Transmission through Building Materials

By J. A. Moyer, State College, Pennsylvania.

(*Read before the American Society of Refrigerating Engineers, Dec.* 8, 1915.)

The work of the Engineering Experiment Station of the Pennsylvania State College in regard to the transmission of heat through various building materials has been devoted to a study of the effects produced by varying velocities and humidity of air over the material tested. Data of this kind have long been needed for the satisfactory and accurate design of heating and refrigerating systems.

All of the tests reported in this paper were made in the thermal testing plant of the Pennsylvania State College, where every effort has been made, without sparing expense, to eliminate all possible difficulties, so that accurate data may be ob-

tained. The calorimeter is roomy, so that large samples can be tested. The means are also available for measuring and varying the velocity of the air; and by the use of accurate and delicate platinum resistance thermometers located in the calorimeter room, at the inside and outside walls of the material being tested, as well as on the surfaces, and imbedded at various distances in the body of the material, it is believed very accurate determinations can be made.

ARRANGEMENT OF PLANT.

This plant consists of two separate brick buildings. One building is 50 ft. by 18 ft. and is used to house a complete 5-ton experimental refrigerating plant. The other building, which is really the thermal testing room, is 32 ft. by 32 ft. on the outside, and contains centrally located within its walls the calorimeter room, which is 17 ft. by 17 ft. This room is cooled to low temperatures by a number of rows of brine coils set up on three sides. Cold brine is supplied from the refrigerating plant in the adjacent building through 2-in. heavily insulated pipes. Each of the materials to be tested is made into a cubical box of approximately 65 sq. ft. of outside surface; and this box is then suspended in the calorimeter room for testing. An electric fan and an electric heating coil are placed inside the box for producing the required uniformly distributed temperature difference between the inside and the outside of the box. By this method tests can be made for a very great range of temperature differences. Absolutely constant and uniform temperatures can be maintained for an indefinite period of time, and the method of measuring the heat put into the box per unit of time is measured by accurately calibrated voltmeters and ammeters on both the coil and the fan circuits. Direct or "continuous" current is used. Twenty platinum resistance thermometers made by the Leeds & Northrup Company, of Philadelphia, according to special designs for this work, are available for measuring the temperature inside and outside the test-box, as well as in its walls. Cylindrical platinum coils are used for measuring temperatures in all places except on the surfaces of the material where thin platinum resistance disks less than 1/50 in. thick are firmly attached to the surface on their flat sides. Adopting the method proposed by the United States Bureau of Standards, the temperatures have been observed in each test of such materials as are obtainable in blocks of considerable thickness, like cork-board, in the following locations: (1) Two feet from the surface of the material tested, inside and outside; (2) 1 in. from the surface. inside and outside; (3) on the outside and inside surfaces by absolutely close contact; and (4) at every inch of thickness through the material, with thin, flat platinum resistance thermometers, which can be accurately located.

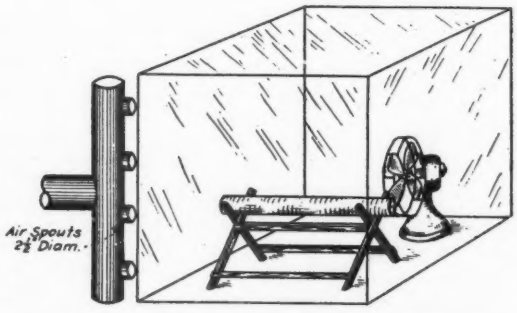

FIG. 1.—APPARATUS USED IN HEAT TRANSMISSION TESTS, FIRST SERIES.

Some of the most important data obtained during the last year will be presented briefly in this paper in the following order:

1. Variation of heat transmission through glass.
   (a) As affected by humidity.
   (b) As affected by velocity of air over surface,
   (c) As affected by various arrangements for directing the flowing air over the surface tested.
2. Variation of heat transmission through common red brick.
   (a) As affected by humidity.
   (b) As affected by velocity.
3. Variation of heat transmission through insulating brick, using high temperatures.

TESTS ON TRANSMISSION OF GLASS.

The series of tests studying the effect of heat transmission of glass was made upon a cubical box made of ¼-in. glass, diagrammatically shown in Figs. 1-3, and having a mean surface area of 66.67 sq.

ft. The box was placed in the calorimeter room and supported about 2 ft. from the floor.

The electrical heating coil, together with a small desk fan, was placed on the inside of the glass box, and thermometers placed 1 in. from the inside surface of the glass, as well as 1 in. from the outside. The temperature within was controlled by the electrical heating coil, and

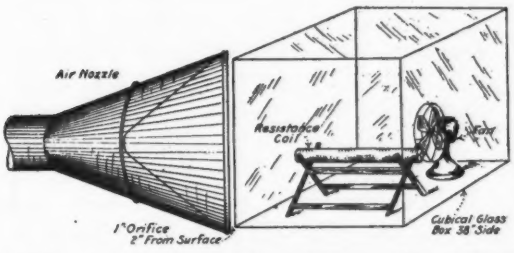

FIG. 2.—APPARATUS USED IN HEAT TRANSMISSION TESTS, SECOND SERIES.

the air surrounding the glass box was maintained constant by the circulation of the brine in the pipes on the walls of the calorimeter room. The heat delivered to the box and transmitted through the material was measured in the form of electrical energy, and the unit transmission for still air circulated by the following formula:

$$H = \frac{(V_c \times A_c + V_f \times A_f)\ 3.41}{(t_1 - t_2)\ S} \quad (1)$$

in which

H = unit transmission (B.T.U. per square foot, per hour. per degree difference of temperature measured 1 in. from the surface of the material tested, inside and outside the box.)

V_c = voltage of heating coil.

A_c = amperes of heating coil.

V_f = voltage of fan.

A_f = amperes of fan.

3.41 = constant in B.T.U. equivalent for one watt-hour.

t_1 = temperature of air in box, 1 in. from material tested.

t_2 = temperature of air surrounding box, 1 in. from material tested.

S = mean area of test box (66.67 sq. ft.).

Tests showing the variation of the heat transmissions with velocity were run similarly to those previously described, but with the exception that one large fan was used to blow air, which was directed by proper ducts, along one side of the box. This velocity ran from 150 to 1,000 ft. per minute and was regulated by dampers suitably located in the ducts. The velocity was measured by means of a carefully calibrated anemometer, averaging the readings for several points along the surface tested.

The heat transmission other than for still-air conditions was calculated as follows:

$$H_2 = \frac{(V_c \times A_c + V_f \times A_f)3.41 - S_1(t_1 - t_2)H_1}{(t_1 - t_2)S_2} \quad (2)$$

H_1 = unit transmission of tested material under still-air conditions (B. T. U. per hour per square foot per degree difference in temperature measured 1 inch from inside and outside surfaces).

H_2 = unit transmission of material tested for velocity.

S_1 = area five sides of test box in still air (55.56 sq. ft.).

S_2 = area material tested (11.11 sq. ft.).

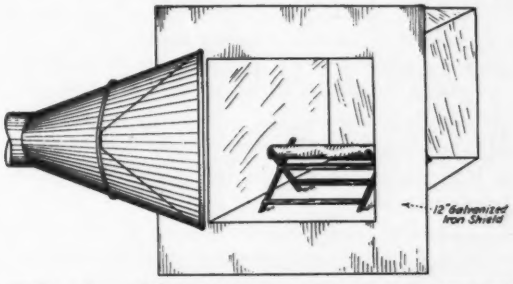

FIG. 3.—APPARATUS USED IN HEAT TRANSMISSION TESTS, THIRD SERIES.

V_c = voltage of coil.

A_c = amperes of coil.

V_f = voltage of fan.

A_f = amperes of fan.

3.41 = constant (B. T. U. equivalent of 1 watt-hour).

t_1 = temperature 1 in. from inside surface. (Average.)

t_2 = temperature 1 in. from outside surface.

It is to be noted in applying formulas for heat transmission with varying velocity that the value of H_1 or the heat transmitted under still-air conditions may have been determined under different condi-

tions of humidity than that for the transmission under varying velocity conditions. It was then necessary, in order to apply this term, to find the effect of humidity on the heat transmission so that the still-air conditions may be corrected to the conditions of the test. The transmission under the given conditions of the test were then corrected to an assumed standard of 80 per cent for comparison.

The varying velocity in the first series of tests upon glass was arranged by terminating the duct from the fan into a small, circular tank or receiver, from which small spouts uniformly distribute the air over the surface tested. The arrangement of apparatus used in the first series of heat transmission tests is shown in Fig. 1 and the results in Table I.

The theoretical disadvantage of this system was due to the possibility of the

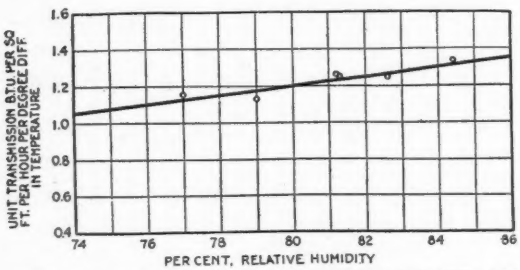

FIG. 4.—EFFECT OF MOISTURE IN AIR ON HEAT TRANSMISSION OF GLASS.

air flowing over the surface in the form of a jet, and thus producing variable velocities.

TABLE I. RESULTS OF TESTS SHOWING EFFECT OF AIR VELOCITY UPON THE TRANSMISSION OF HEAT THROUGH GLASS. GLASS CUBE EQUIPPED WITH AIR SPOUTS (Fig. 1).

Test No.	Air velocity ft. per minute	Humidity %	Unit trans. given conditions	Unit trans. corrected to 85% humidity
8	0	77	1.154	1.234
9	400	80	1.640	1.640
10	600	79	1.858	1.883
11	950	79	2.115	1.140

In the second series of tests on glass with varying velocities, the objection to the use of spouts was overcome by arranging the apparatus so that the air would be delivered over the surface in a thin sheet. This was accomplished by terminating the duct into a flattened cone or nozzle, as shown in Fig. 2. The results are given in Table II.

The arrangement of the apparatus used in the second series gave results that were very high as compared with the results as obtained from the first series. The discrepancy was thought to be due to the production of eddy currents over the surfaces having apparently still-air conditions. In the third series of tests this objection was eliminated by placing a galvanized iron shield 12 in. wide around the surface tested. The results of the tests are given in Table III and the apparatus is shown in Fig. 3.

The results of the tests on the effect of humidity upon the transmission of heat through glass are given in Table IV and graphically shown in Fig. 4.

TABLE II.—RESULTS OF TESTS SHOWING EFFECT OF AIR VELOCITY UPON THE TRANSMISSION OF HEAT THROUGH GLASS. GLASS CUBE EQUIPPED WITH AIR CONE, BUT WITHOUT SHIELD. (Fig. 2).

Test No.	Air velocity ft. per minute	Humidity %	Unit trans. given conditions	Unit trans corrected to 80% humidity
12	0	84.4	1.338	1.230
13	350	80.3	4.007	4.000
14	600	75.5	4.427	4.530
15	1,025	82.6	4.772	4.708
16	1,120	79.6	5.600	5.605

TABLE III—RESULTS OF TESTS SHOWING EFFECT OF AIR VELOCITY ON THE TRANSMISSION OF HEAT THROUGH GLASS. GLASS CUBE EQUIPPED WITH AIR CONE AND 12-IN. GALVANIZED IRON SHIELD. (Fig. 3.)

Test No.	Air velocity ft. per minute	Humidity %	Unit trans. given conditions	Unit trans corrected to 80% humidity
17	0	81.3	1.263	1.230
18	420	74.1	3.409	3.560
19	865	75.8	3.798	3.900
20	1,000	79.0	4.010	4.035
21	1,000	77.2	3.973	4.040
22	1,200	79.5	4.207	4.220

TABLE IV—RESULTS OF TESTS SHOWING EFFECT OF HUMIDITY UPON THE TRANSMISSION OF HEAT THROUGH GLASS. (Fig. 4.)

Test No.	Air Velocity, Ft. Per Min.	Humidity, %.	Unit Transmission.
1	0	77	1.154
2	0	79	1.129
3	0	81.2	1.260
4	0	81.3	1.255
5	0	82.6	1.256
6	0	84.3	1.288
7	0	84.4	1.338

The results of the tests given in Tables I, II, and III are reproduced graphically in Fig. 5.

TESTS ON THE TRANSMISSION OF COMMON RED BRICK.

The study of the transmission of heat through common red brick was performed with apparatus similar to that used in the study of the transmission of heat through glass. A brick cube was constructed of a single thickness of ordinary red building brick laid in approximately

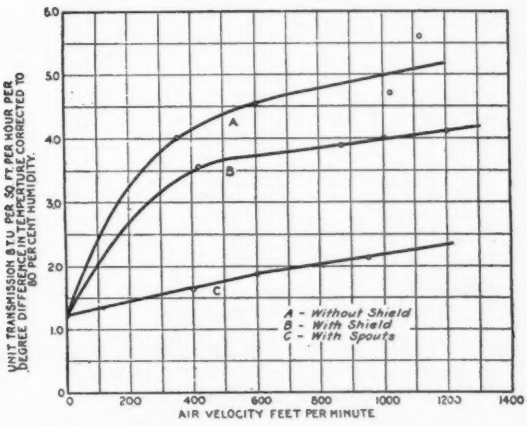
UNIT TRANSMISSION B.T.U. PER SQ. FT. PER HOUR PER DEGREE DIFFERENCE IN TEMPERATURE CORRECTED TO 80 PER CENT HUMIDITY.
AIR VELOCITY FEET PER MINUTE
A - Without Shield
B - With Shield
C - With Spouts

FIG. 5.—EFFECT OF AIR VELOCITY ON HEAT TRANSMISSION OF GLASS.

¼-in. lime mortar. The general outside dimensions were 46 in. square, thus making the inside dimensions 38 in. square, as was the case of the glass cube. The heat was supplied to and transmitted through the brick cube, as well as temperature readings, etc., were obtained in the same manner as described for the test made on th glass box.

In the first series of tests the effect of humidity upon the transmission of heat was studied. This was accomplished under still-air conditions and calculated by formula (1), the results of which are shown in Table V.

In the second series the effect of varying the velocity was considered. In this series the apparatus used was identical to that used for glass in the second series of tests, or, in other words, by the use of an air cone or nozzle without a shield. The heat transmission was calculated by equation (2). Results of these tests are given in Table VI.

TABLE V—RESULTS OF TESTS SHOWING EFFECT OF HUMIDITY ON THE TRANSMISSION OF HEAT THROUGH COMMON RED BRICK. (Fig. 6.)

Test No.	Air velocity, ft. per minute	Humidity %	Unit transmission
23	0	81	.6645
24	0	83.5	.6986
25	0	83.9	.7094
26	0	84	.7035
27	0	86.5	.7287
28	0	88	.7617
29	0	89	.760
30	0	94	.7780

TABLE VI.—RESULTS OF TESTS SHOWING EFFECT OF AIR VELOCITY ON THE TRANSMISSION OF HEAT THROUGH COMMON RED BRICK. BRICK CUBE EQUIPPED WITH AN AIR CONE, BUT WITHOUT SHIELD. (Fig. 6.)

Test No.	Air velocity ft. per minute	Humidity %	Unit trans. given conditions	Unit trans. corrected to 80% humidity
31	0	84	.7035	.6635
32	210	83.8	1.157	.9350
33	230	90.5	1.081	.9700
34	450	91	1.190	1.075
35	660	91	1.223	1.110
36	660	89	1.251	1.160
37	765	90	1.272	1.155
38	850	91	1.280	1.177
39	1,050	91.2	1.348	1.230
40	1,100	93.8	1.400	1.250
41	1,530	89	1.420	1.330
42	1,530	88	1.436	1.355

Fig. 6 contains curves showing the effect of air velocity and humidity on the heat transmission of common red brick.

TESTS ON THE TRANSMISSION OF HEAT THROUGH INSULATING BRICK.

The tests upon the heat transmission of insulating brick were made to study the effect of the transmission of heat through this material under high temperature differences. The unit transmission for this material had never been accurately determined.

The apparatus used in testing the heat transmission of this material was identical with the apparatus used in the tests

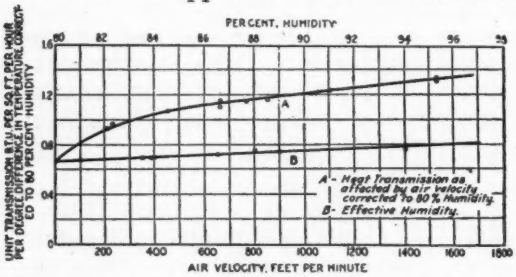

FIG. 6.—EFFECT OF AIR VELOCITY AND HUMIDITY ON HEAT TRANSMISSION OF COMMON RED BRICK.

of common red brick, as previously described. A cube of insulating brick was constructed by a single layer of the bricks, the outside dimension of which were 46 in. square, thus making the inside dimension 38 in. square, as was the case of the glass cube. The heat supplied to the cube, as well as temperatures, etc., were measured as in other tests. All the tests were run under still-air conditions, the surfaces tested being subject only to the velocity created by natural circulation and the internal temperature maintained inside the cube was varied from 800° to 1,700° F. The results of these tests are shown graphically in Fig. 7.

CONCLUSION.

These data show that the transmission through glass and red brick is increased very materially with increase in humidity. Thus for glass the unit transmission was increased 0.25 B.T.U. by increasing the humidity from 74 to 84 per cent, which is equivalent to a change of 24 per cent in transmission for a variation of 10 per cent. in relative humidity. For red brick the unit transmission was increased 0.102 B.T.U. by increasing the relative humidity from 80 to 90 per cent., which is equivalent to a change of 15 per cent. for a variation of 10 per cent. in relative humidity.

The effect of velocity on the transmission of heat, as shown by the data, varies greatly, depending upon the arrangement for conducting the air over the surface tested. In the case of glass the unit transmission corrected to 80 per cent. humidity, and at 1,000 ft. per minute velocity has these values: 2.19 B.T.U. for a cube equipped with sprouts; 4.00 B.T.U. for cube equipped with air cone alone. These factors show very conclusively that in studying the effect of velocity upon the transmission of heat through a material, the arrangement if apparatus for protecting that portion of the material which is considered under still-air conditions is of the utmost importance.

It is true, the arrangement of the apparatus as used in the first series of velocity tests, or, in other words, equipping the glass cube with the air spouts, gave values which are low, due to the variable velocities produced by the jets, while, on the other hand, the failure to protect the surfaces not directly acted upon by the moving air gives too high results In all probability the results with the use of air cone and shield, or as shown in the second series of tests upon glass, give the best results. Assuming this to be true, it is interesting to note

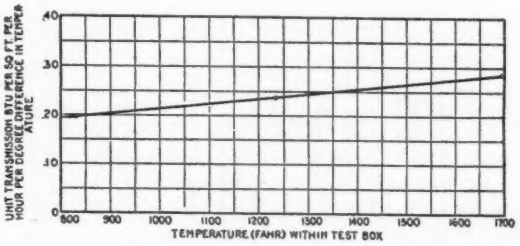

FIG. 7.—EFFECT OF TEMPERATURE ON HEAT TRANSMISSION THROUGH INSULATING BRICK.

that in the case of glass the unit transmission when corrected to 80 per cent. humidity gave an increase of 2.78 B.T.U. for an increase of velocity from 0 to 1,000 ft. per minute, which is equivalent to an increase of 220 per cent. per 1,000 ft. per minute of air velocity.

The Engineering Experiment Station, in continuing the study of the effect on heat transmission with varying velocities of air by different arrangements of apparatus, is replacing the glass cube as used in the tests reported here by making

five sides of the cube of cork board and the sixth of glass. It is thought that by this arrangement the effect of eddy currents upon the surfaces assumed to be in still air may be practically eliminated owing to the small unit transmission of cork.

The transmission of heat through common red brick was obtained by use of apparatus similar to that shown for glass in the second series of tests or the brick cube was equipped with air cone without shield. These results, judging from the effect of the arrangement as shown in the tests on glass, will be high. But the percentage of error introduced will be small, owing to the low value of the unit transmission of brick. The results of these tests on common red brick when corrected to 80 per cent. relative humidity show an increase in unit transmission of 0.56 B. T. U. for an increase of an air velocity from 0 to 1,000 ft. per minute, which is equivalent to an increase of 84 per cent. for an increase of 1,000 ft. per minute in velocity.

These results seem to indicate that in the calculations for the design of heating and refrigerating plants the old method in which an exposure factor is assumed to cover the effect of velocity should be revised.

The increase in heat transmission due to the same velocity is not the same for all materials, and that instead of the use of an assumed constant which is the same for all materials, new values should be obtained for each material. The effect of humidity is another factor which has heretofore been neglected, and, while under ordinary conditions, may not effect the transmissions in a practical sense, yet in installations when the humidity is high this increase in the transmission should not be overlooked.

In the test made upon insulating brick, while the number of tests were small, no definite conclusions can be drawn, but from the results obtained the unit transmission does not remain constant, and varies considerably with the temperature within the test box.

Heating a Chicago Office Building

By S. Morgan Bushnell.

(Read before the American Society of Heating and Ventilating Engineers, January 20, 1916.)

In the following description of the heating of a large office building, an attempt has been made to give a practical illustration of the heating requirements of a modern office building and to show in a general way the relation between theoretical calculations and the actual results under typical operating conditions.

The building under consideration is located at the northeast corner of Clark and Adams Streets, Chicago, is 181 ft. by 190 ft. in area, with a height of 260 ft., and above the fourth floor has a court 60 ft. by 120 ft.

The building was formerly occupied by the Continental & Commercial National Bank, but on the completion of their new structure at Adams and La Salle Streets, the bank moved out and the building has since been occupied by the Commonwealth Edison Company, the local company which supplies electricity throughout the city.

The building was formerly equipped with plunger hydraulic elevators which were operated in connection with a steam plant which also provided steam for heating and for driving the electric generators which provided light and power in the building. About two years ago the dynamos and engines were removed and the plunger hydraulic elevators were replaced by one-to-one traction type electric elevators. The building now purchases electricity from the Commonwealth Edison Company and steam from the Illinois Maintenance Company, according to the regular printed contracts of these companies. This change in the method of operation has resulted in a substantial saving in the annual operating costs of the building.

The consumption of electricity is high for a building of this size, due mainly to the fact that it is the headquarters of the Commonwealth Edison Company which uses light very lavishly both in its offices and in its show rooms on the first floor. The steam requirements are also high, due to the fact that steam is left on all night to accommodate some of the employees of the Edison Company, particularly the load despatcher's office.

In accordance with the policy of a number of large Chicago office buildings, the building management has made a contract on the meter basis with the Illinois Maintenance Company to supply steam from the boiler plant in the basement in accordance with their regular price schedules. An arrangement is also made with the Illinois Maintenance Company to supply labor to take care of the plumbing, radiation and electrical apparatus up through the building, also for the maintenance of the elevator system.

STEAM REQUIREMENTS FOR THE PAST YEAR.

Steam is used simply for heating and hot water service in the building and accordingly the summer requirements are comparatively small. During the past summer season, the weather was especially cool and steam was required for heating the building at times even in the summer months.

The steam is measured by St. John meters, and the following table shows the requirements during the past year beginning with December, 1914:

Months.	Lbs. of Steam.	Cost.
December, 1914...	9,358,000	$3,481.38
January, 1915.....	10,014,000	3,717.54
February, 1915...	7,815,000	2,925.90
March, 1915.....	8,390,000	3,132.62
April, 1915.....	3,642,000	1,423.62
May, 1915.....	3,356,000	1,320.66
June, 1915.....	897,000	430.79
July, 1915.....	441,000	238.95
August, 1915.....	482,000	257.40
September, 1915..	794,000	389.07
October, 1915....	2,754,000	1,103.94
November, 1915...	5,121,000	1,956.06
Totals	53,064,000	$20,377.93

From the above it may be seen that the cost of steam service in the building amounts to about $20,400 per year, at an average price of a little over 38 cents per thousand pounds. This price is very low, due to the fact that the heating company does not have any investment in boilers or steam pipe lines, the steam generating plant being furnished by the building, while the heating company simply furnishes the labor and supplies to operate the plant. Judging from the steam that is used during the summer months, it is assumed that the steam requirements for hot water service approximate 500,000 lbs. per month. Deducting from the above total of 53,064,000 lbs. 6,000,000 lbs. for hot water, service makes the net heating requirements of the building, in round numbers, 47,000,000 lbs. of steam per year.

COMMONWEALTH EDISON BUILDING, CHICAGO.

COMPARISON BETWEEN THEORETICAL AND ACTUAL REQUIREMENTS.

It might be interesting to make a comparison between the theoretical steam requirements and the actual results. The building is a modern steel and terra cotta

building, having an outside wall exposure of 149,192 sq. ft., glass surface of 85,558 sq. ft. and a roof surface of 27,190 sq. ft. The formula used by the heating company is:

$$T = \frac{S \times 0.2}{E}$$

in which

T = Number of tons of coal used per year.

S = The equivalent glass surface in square feet.

E = The factor of evaporation.

In order to find the equivalent exposure in square feet of glass surface, to the total glass area, add one-tenth of the net wall area, including the roof, allowing 10% additional for the north and west exposures. It has been found as a matter of experience that in this building an average evaporation of 5½ lbs. of steam per pound of coal is obtained. The equivalent glass exposure equals 107,031 sq. ft. Substituting these values in the heating formula $\frac{S \times 0.2}{E}$ gives $\frac{107{,}031 \times 0.2}{5\frac{1}{2}}$ or 3,892 tons of coal per year. Taking our evaporation of 5½ lbs. per pound of coal, each ton of coal would generate 11,000 lbs. of steam, therefore the theoretical heating requirements would be 3,892 × 11,000, or 43,812,000 lbs. of steam per heating season. This figure assumes that the building is equipped simply with direct radiation. In this particular building there is an equivalent heating surface in the indirect system for the basement and lower floors of 4,000 sq. ft., assuming that the indirect radiation will require double the amount of steam per square foot that the direct radiation requires. Taking one-half of 4,000 sq. ft. times 783 lbs. of steam per square foot per season, gives an additional 1,566,000 lbs. Adding this to the theoretical requirements in direct radiation, there is a total of 45,378,000 lbs. per year. As compared with the actual results or 47,000,000 lbs. during the past season, the consumption is a little over 3½% above the theoretical requirements. This may be explained partly by the fact that the temperature during June and September, 1915, was below the average, requiring steam for heating at certain times, and also by the conditions above stated, viz.: the unusual steam requirements at night.

The installed radiation in the building is about an equivalent of 60,000 sq. ft. of direct radiation. Dividing this into 47,000,000 lbs. of steam, we have a consumption of 783 lbs. of steam per season per square foot of radiation. This amount is a little higher than has been found customary in similar buildings in Chicago. This may be explained by the fact that the radiation installed is slightly under the customary required amount, viz.: 107,000 the equivalent glass surface $\times \frac{6}{10}$ equals 64,200 sq. ft.

ARRANGEMENT OF HEATING EQUIPMENT.

The accompanying diagram shows the general arrangement of the heating equipment in the building. It will be noted that the design is a one-pipe overhead or down-feed system and is operated with the Paul vacuum system, and the Johnson thermostatic type of heat regulation. The heating throughout the building is done by means of live steam, the steam being furnished from the boilers at a pressure of 90 lbs. and expanded through a 12-in. reducing valve into a tank at a pressure slightly above atmosphere, depending upon the temperature. As shown in the illustration, the steam for the upper floors is carried through an 18-in. riser to the roof, where distributing lines connect with branch risers leading to the basement return headers. The heating of the first floor is supplied by a separate pipe feeding from the expansion tank. There is also a separate supply leading to the heating coils of the indirect heating system. The Paul air valve lines are carried from the different radiators alongside the risers to the basement, where they enter a manifold connected with the suction of the vacuum pumps. The bottoms of the various risers are connected to basement return headers which carry the return waters of condensation back to the heaters, whence they are pumped back to the boilers.

The St. John meters are installed

where the main steam line leaves the boiler header and there are two 6-in. meters in multiple for the maximum load. Thus far one meter has been found sufficient, even in cold weather, and the valve to the other meter is closed. The system operates under average conditions with 18 in. of vacuum.

There are about 78 secondary steam risers, each riser having a diameter of 3 in. at the upper floors and 2 in. at the basement. The thermostats are placed at suitable points in the different rooms, it being the endeavor to locate them at points in the room where the average conditions of heat prevail. The radiators are all located at the windows, with a view to minimizing changes in radiation when partitions are removed.

The air pressure for the Johnson system is supplied by two 3-horsepower motors which consume about 27 kilowatt hours per day. The air pressure used is about 15 lbs. per square inch.

Inasmuch as some buildings provide the steam heating from a plant which also provides electric light and power, the itemized costs of central station electrical service in connection with the miscellaneous supplies required in the building are also given in order to show the relation between the different items and to make easier a comparison with other buildings.

FIGURES FOR ELECTRICAL CONSUMPTION.

The figures on the electrical consumption cover the same period as those given above for the steam consumption and are as follows:

	K. W. Hours
December, 1914	84,640
January, 1915	84,890
February, 1915	109,480
March, 1915	127,000
April, 1915	129,510
May, 1915	126,200
June, 1915	126,310
July, 1915	126,860
August, 1915	138,850
September, 1915	170,055
October, 1915	157,205
November, 1915	218,926
Total	1,599,946

The total consumption for the year for elevators was 390,610 K. W. hours; for miscellaneous power, 208,250 K. W. hours; for corridors and public lighting, 128,190 K. W. hours; for tenants, including the electricity used by the Edison Company, 872,896 K. W. hours. The rate earned by the building under the lighting company's wholesale schedules is less than 2c. per K. W. hour, making the total cost of electricity for 1,600,000 K. W. hours about $32,000.

Inasmuch as the largest tenant is the Edison Company, the building does not derive any profit from retailing electricity for a large portion of the space. If all the electricity used by tenants were sold by the building, as is the case in a number of other buildings, at an average of 5 or 6 cents per K. W. hour, the income from the tenants would more than pay for the entire cost of the electricity for the building. The comparatively low consumption of electricity during the first months of the year was due to the fact that several floors of the building were being remodeled for the use of the various departments of the Edison Company, which moved in during the year.

In addition to the cost for steam and electricity, the building pays the Illinois Maintenance Company approximately $4,000 per year for the care of fans, radiation, plumbing and elevators throughout the building. It also pays $3,300 per year for two electricians employed in the building. The building has the following expenses for supplies:

Electrical supplies	$474.00
Elevator supplies	1,038.00
Heating supplies	493.00

Summarizing the above, we have as follows:

Electricity	$32,000.00
Steam	20,377.93
Additional labor furnished by heating company	4,000.00
Electricians	3,300.00
Electrical supplies	474.00
Elevator supplies	1,038.00
Heating supplies	493.00
Total	$61,682.93

SAVING IN OPERATING COST.

In round numbers, the cost, therefore, of heating and furnishing the electrical requirements of this building which, as

seen from the above, are unusually heavy, amounts to about $62,000 per year. Three years ago, the cost of operating the building from a private plant with hydraulic elevators, including fixed charges on the investment for dynamos and engines, was about $75,000, and the electrical requirements amounted to about 1,300,000 K.W. hours per year, low efficiency lamps being used at that time. Comparing the cost of steam, therefore, with the total cost of operating a complete plant, we see that the ratio of the heating cost to the total is about the same as one to three and one-half.

FIGURING BOILER HORSEPOWER RATIO.

In a paper read before the Society last September by Mr. James A. Donnelly, an interesting table was given for the transmission of that at various temperatures from cast-iron radiators. Where the steam temperature is 210° F., the transmission is given at 250 B.T.U. per hour per square foot of radiation. The ordinary heating season in Chicago is 243 days. The average period during which steam is on the radiators of an office building will run about 12 hours per day. If in this particular building we assume a little higher average,

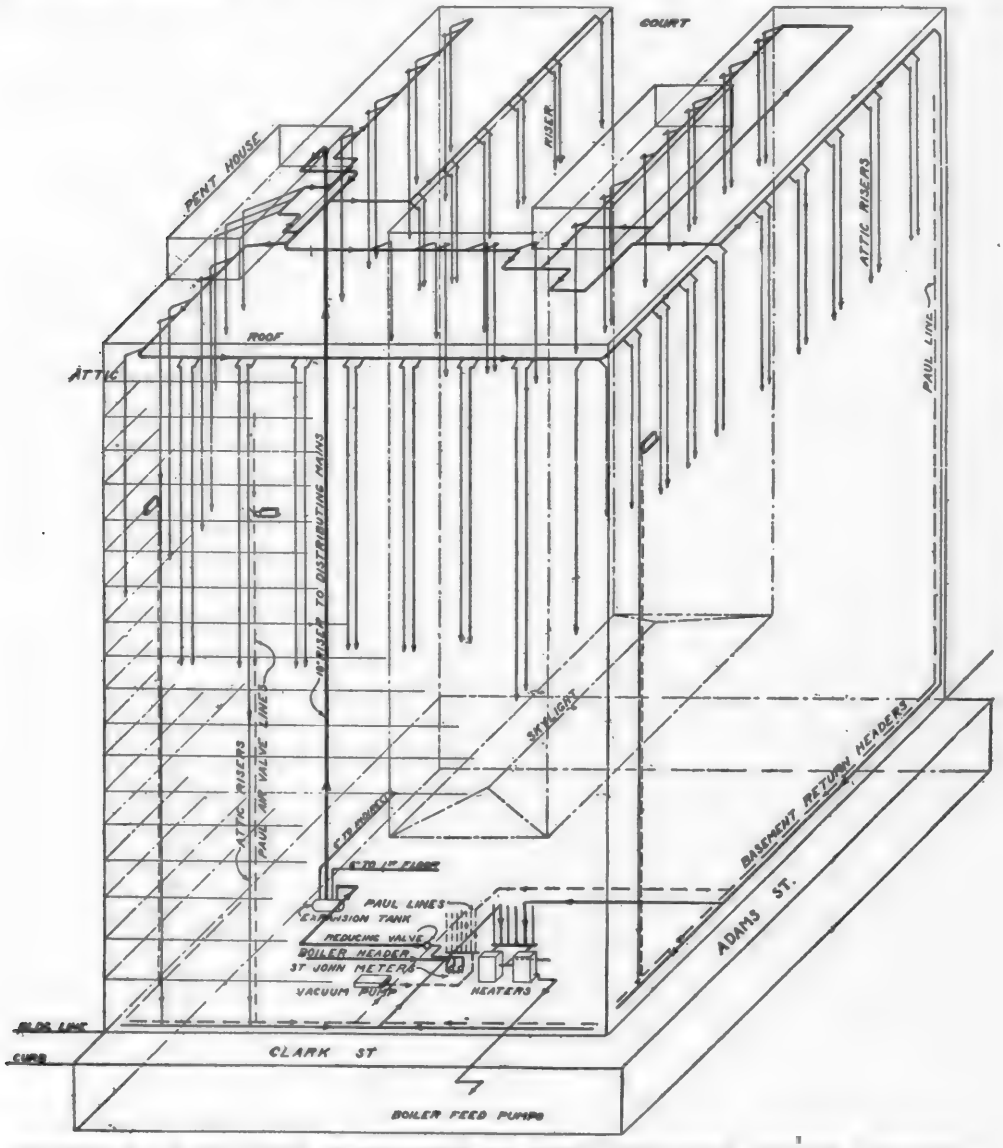

DIAGRAM OF HEATING EQUIPMENT IN COMMONWEALTH EDISON BUILDING, CHICAGO.

perhaps 13 hours per day, there will be 3,159 hours during the heating season. 250 B.T.U. per square foot per hour, times 3,159 hours, gives 790,000 B.T.U. per square foot of radiation. Assuming about 1,000 B.T.U. for each pound of steam gives 790 lbs. of steam per square foot of radiation. Multiplying this by the total of 60,000 sq. ft. gives 47,400,000 lbs. as the amount of steam which would be used during the season. This is a little higher than the actual consumption of steam in the radiators. The maximum steam consumption during the winter in any hour as shown by the meter charts was 17,800 lbs. per hour. This at 30 lbs. of steam per boiler horsepower would be the equivalent of approximately 600 horsepower. A comparison with the total square feet of radiation gives a ratio of one horsepower in boiler capacity used to each 100 sq. ft. of radiation.

CAN HEATING REQUIREMENTS BE DETERMINED FROM A SHORT TEST?

The question frequently arises as to whether it is possible by making a test on the heating requirements of a building during two or three days, to approximate the heating requirements during the entire heating season. About the middle of November, 1915, the daily mean temperature for about a week averaged between 38° and 40° F. If the heating season in Chicago is taken as beginning October 1 and ending May 31, or a period of 243 days, the average temperature during that time is 39° F. It would therefore be interesting to find out whether the consumption of steam during these days (which happened to have average temperatures for the season) corresponds with the average for the heating season. Deducting the steam consumption during the four months of summer, there is an actual consumption for the heating season of 50,450,000 lbs. During this week in November, while the average temperature was about 39°, the meter showed about the same consumption each day, viz.: 210,000 lbs. Multiplying 210,000 lbs. by 243, the number of days in the heating season, gives a total of 51,030,000 lbs. This checks very closely with the actual consumption of 50,450,000 lbs., and would tend to indicate that where the temperature is approximately stationary for several days, a fair idea of the heating requirements for the season can be obtained from a short test. This probably would not prove true if the temperature should vary greatly from day to day, as there is a certain lag between the steam requirements of a building and the outside temperature.

In making estimates based on such tests, it, of course, should always be borne in mind that the steam requirements are not proportional to the variation in outside temperature, but to the difference in degrees between the indoor temperature and the outside temperature.

OPPORTUNITY FOR CHECKING VARIOUS HEATING FORMULAS.

It is very interesting to check the various theoretical formulas which have been proposed, with actual conditions in the heating of buildings. The empirical formula which is used in Chicago for estimating the heating requirements of large buildings not only is based on experience from heating a large number of buildings, but also has been deduced by taking certain values in the general formula for heating, which is based on the amount of heat radiating surface on the outside of a building and the rate at which the air is changed in the building through ventilation and leakage. There is perhaps no line of endeavor in which it is more necessary that theory and experience walk side by side than in the subject of heating and ventilation. In view of the fact that fairly satisfactory and dependable instruments can now be obtained for measuring the quantity of steam and the pressure which is maintained, a large amount of information should be collected as to the heating requirements in various classes of buildings.

New Ideas in Air Conditioning

By W. E. WATT, A.M., PH. D.

Muskegon, Mich., has had its worst building condemned by the State Board of Health and now it is the best-ventilated building in the city. Now comes an order for more work for the Muskegon Board of Education. The high school at Joilet —87 rooms—has been accepted and a capacity test was held in the assembly hall with visiting educators looking on. The president of the Board of Education says we have taken a building with a fan that was manifestly too small and made it large enough with less than maximum speed, and we have already saved $500.00 *in fuel this Winter.*

The accompanying article seems to hit the ventilating engineer, but that is not really the case. It hits the data and standards which they have been instructed to rely on and which are wrong. The universities are teaching the errors and the engineers are desirous of finding out why teachers and pupils became anemic when they have done their best to give them pure air.

I permit open windows in all sorts of buildings and give in warm open air schools the same benefits secured in cold schools at great cost.—W. E. WATT.

The request of the editor for a statement of the new work being introduced into the schools of Michigan to get a better quality of air, and better scholarship and health, leads me to make here a few rather brief statements, which I know will be challenged, but which I can not here take space to verify. I shall content myself with the facts without details. One leading architect of the United States said to me one day when he was in agony over unsatisfactory results in a building he had just finished at a cost of more than one million dollars, "There is not one ventilating engineer in this city who can do what he says he will." I asked him how far he would have to go from this city to find the sort of air engineering he was seeking, and he enlarged his statement to include the whole country. His statement is too sweeping, but it was made at a time when had gone the limit in expense, and had procured bad results.

The difficulty in standard ventilation lies mainly in three errors, which have been pretty generally adopted by the profession and our universities, any one of which is sufficient to give bad results.

THE CARBON DIOXIDE ERROR.

The first error is the assumption that foul air falls to the floor. Carbon dioxide is heavier than air by about fifty per cent. Clear carbon dioxide will pour from a dish like water, and lies upon the floor, but it will immediately begin to rise, and diffuse throughout the room. Gases do not separate out into layers as liquids do, but every gas diffuses and fills the whole space regardless of the presence of other gases. For instance, a receptacle may be completely full of air, and then receive without any crowding a complete filling of carbon dioxide, another complete filling of water vapor, and other complete fillings of other gases, each gas finding ample room for itself whether the others are present or not.

Out-breathed air is warmer than the air which we choose to live in, and because it is warm it goes up. It lies in a layer near the ceiling, but not in a distinct layer. It begins to diffuse at once, but is what I call a dead combination of gases, and diffuses quite slowly. It is decidedly different in the case of diffusion of illuminating gas. One cubic inch of illuminating gas released in a large room reaches all parts of it, but the warm effluvia from skin and lungs rise to the ceiling, and may be skimmed off before diffusing very much.

For this reason I use skimming outlets at the ceiling. The standard practice is to dilute the air sewage with new air until the mixture shows but six or eight parts of carbon dioxide in 10,000. If the city fathers should mix the sewage of the city with drinking water, six parts to ten thousand, there would be a great outcry, although what we breathe is of very much more importance than what we drink or eat.

THE ARIDITY ERROR.

Air that is warmed at all becomes somewhat arid. It is well known that unless humidity is applied in winter the conditions for health are not good. A great deal has been said recently about using humidity, but the devices employed have, in many cases, failed to secure satisfactory results, and so many fine, new buildings are being erected this year with no provision for proper humidity.

In a school or church, you must have humidity or stupidity. It often happens that winter air contains less than five per cent. of relative humidity outdoors. When this is warmed the humidity is reduced twenty or twenty-five volumes, making the amount of humidity indoors less than one per cent., and in some cases merely a trace. It is not wise to bring up children in a house that is worse than a drying kiln. No business, study, or mental work of any kind can be well done in a room where the air is dead and drier than that of the desert of Sahara.

But in using humidity it is necessary that the air be alive in order to carry the humidity properly, otherwise it becomes a fog, and the conditions are unsatisfactory. So we must see that the air is not killed by the heating plant, and then we find that less than thirty per cent. of relative humidity is frequently entirely satisfactory, where in dead air two or three times as much water does little good.

THE FRESH AIR ERROR.

The most ignorant janitor of a small church is pretty apt to know that he can heat live air more easily than dead air. Everyone who has mounted a step-ladder in any warmed room knows that the air near the ceiling is not as invigorating as outdoor air, and anyone who has stood on a step-ladder before the inlet of a scientifically ventilated room, finds that the so-called fresh air, on entering the room, is decidedly different from what the ventilating engineers would have him believe.

I am unable to find in any work on ventilation one word about air that is alive, or radioactive, or ionized. Yet the air outdoors is alive, and ionized, and radioactive. Physicians tell us there is no cure for tuberculosis, except outdoor air, good feeding, and rest, and the outdoor air is the main factor. In cases of pneumonia they prescribe fresh air only. What medicine they give is merely given to satisfy the watchers. Live, ionized, radioactive air is the cure for tuberculosis, pneumonia, fatigue, indigestion, constipation, and all the foul air diseases. It reddens the blood, sharpens the intellect, cheers the mind, and produces resistance to fatigue and diseases.

In warming air for our buildings where we throw a house full of air towards the sky every four to seven minutes, it is necessary to heat the air almost instantly. This requires very great heat. This heat takes the life out of the air.

That is why school teaching has become a hazardous occupation in the last forty years. The life insurance companies now rank the teacher at the bottom of the list with the saloon keeper and marble cutter in peril of tuberculosis. This change in insurance risks has been co-incident with the introduction of rapid ventilation in our city schools and colleges.

THE CORRECTED PRACTICE.

By avoiding these errors, it is possible to supply a building with air that is properly warmed, not killed, rightly humidified, and somewhat cooler than the air commonly used.

To equip a new building to do this costs very much less money than the standard equipment, and the running expenses are cut still more drastically. The work is not done to save money, but the air of a building cannot be made right and kept right when the ordinary amount of fuel and current is consumed. I found I had to cut them down in order to treat the air more gently and avoid killing it. I also found that temperatures from 6° to 10° lower than usual are preferred when the air is right. Here is another saving of from fifteen to twenty-five per cent in fuel.

This subject is a complicated one, but problems have been solved so that we may now condition the air in any sort of building using whatever ventilation apparatus has been installed. About the only change noticeable in a school room which has been condemned by the Board of Health and transformed into one of the best rooms in the city, *is a small skim-off high in the wall,* and the cheerful aspect of the teacher and pupils.

We have found that education in live

air, rightly humidified with the air sewage eliminated instead of diluted, is a much easier process than education in a building ventilated according to standard practices. The efficiency of employees in banks, business houses, shops, and factories is noticeably increased. I have some very interesting statistics on this, which I hope to gather into readable shape before long.

In our thin clothing in summer we enjoy air at 60° or 62° F., while in winter with heavy clothing we often find 10° higher quite necessary to avoid a chill. The new practice of air conditioning is merely an attempt to make the indoor air of winter somewhat resemble the outdoor air of summer.

THE BUSINESS OUTLOOK.
III.

By FRANK M. HUSTON,

Financial Editor of the Chicago Evening Post; Editor Rand-McNally Bankers' Monthly.

With prosperity in evidence in all directions and with a year behind us containing developments unprecedented in the history of the country we are entering a period that promises a further broadening of the field of American endeavor. That our war business with Europe has stimulated a revival of general business activity, to an extent unbelievable a year ago, is obvious.

The year to come is likely to develop into a period of stabilizing this activity through an expansion of domestic business. Profits from the war business have been abnormal. This is evidenced by the fact that our volume of trade with foreign countries in the last year totals $5,355,580,000. Out of this we have created a credit balance of approximately $1,747,390,381. This affords us fortification in a financial way that necessarily must minimize the evil effects of the economic readjustment which the cessation of hostilities in Europe will bring.

What the effect of the war will have upon the far future of nations is difficult to foresee. Suffice it, however, to say that there are unmistakable evidences that this country is no longer dependent upon the European war for its prosperity. The tremendous war orders poured in upon us have stimulated but did not create the forces making for great activity here. The United States had been passing through a period of relatively lean years and a fat year was about due. Uncertainty following the outbreak of the war caused hesitancy for a period which the influx of orders to fill the needs of Europe dispelled, until now many lines of trade and manufacture are running at full capacity.

It is well, therefore, to note the salient features bearing directly on the economic position of this country.

First, and foremost, the enormous increase in exports which, combined with lightly increased imports, brought us a total trade exceeding the largest previous year by 25% and yielding a credit balance two and a half times as great as any previous balance in our favor.

Second, increased banking facilities under the operation of the Federal Reserve System and in consequence of an inflow of $415,000,000 in gold, affording us a rapid increase in available credit.

Third, farm products exceeding $10,000,000,000 in value and stimulating a much needed diversification in crops in the south.

Fourth, recovery in railroad earnings, stimulating the impaired credit of the railroads and restoring normal purchasing power to our transportation systems which are the chief customers of other industries.

Fifth, revival and growth of manufacturing under the stimulus first of war orders and of a greatly stimulated home demand, to an extent unprecedented, especially in the steel trade.

Sixth, the absorption by American investors of approximately $1,200,000,000 of our securities formerly held in Europe, without serious disturbance to our own credit situation.

Seventh, the development through the channels of trade and finance of an international, in lieu of a provincial, position in the world's banking, and the reaching out for a more active participation in the world's trade.

Eighth, revival in American shipbuilding and the determination to develop a merchant marine in keeping with the country's resources and the increase in our foreign commerce.

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The Government's Publication of Mid-Day Humidity Readings.

Some time ago the announcement was made in these columns that through the efforts of W. G. R. Braemer, of Warren Webster & Co., the government had arranged for the taking and publishing of mid-day humidity readings at certain of the Weather Bureau stations. Efforts to obtain these mid-day readings for use in connection with the weather charts published in THE HEATING AND VENTILATING MAGAZINE have brought out the information that while these records are given out for local publication no permanent record is made of them as yet by the Weather Bureau, except in the case of New York.

It is the intention to incorporate them in the weather charts referred to as soon as the data are available.

THE HEATING AND VENTILATING MAGAZINE

Vol. 13 February, 1916 No. 2

PUBLISHED MONTHLY BY THE

Heating and Ventilating Magazine Co.

1123 BROADWAY, NEW YORK

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Subscription	$1.00 per year
Canada	1.25 " "
Foreign countries	1.50 " "
Back numbers	15 cents each
Back Nos. prior to current year.	25 cents each

FOLLOWING closely upon the need of adequate ventilation facilities in motion picture theatres comes the news of another new field of activity for the ventilating engineer. This time it is in connection with the ventilation of garages, both public and private. In the last month there have been reported several cases of asphyxiation from automobile gas fumes which Chicago physicians have defined as "petromortis." In these cases the victims were found seated or standing alongside their cars in garages, apparently suddenly overcome while making adjustments or testing the motor.

In commenting on this new danger of working on a motor car in a closed garage, it is urged that if work must be done with the motor running, the doors and windows should be open to provide a free current of air or adequate ventilation provided by other means.

In the cases recently reported it would seem that death came too soon and after too short a period of combustion to be the result of mere oxygen exhaustion of the air in the room, and the conclusion has been reached that they are clear cases of carbon monoxide poisoning.

One remedy proposed is the use of a pipe with a flexible connection attached to the exhaust so that the exhaust of any motor can be conducted out-of-doors. This might well do for the small garage, but in larger buildings used for this purpose it will probably open the way for the installation of complete mechanical ventilating equipments.

TWO achievements, consummated at the recent annual meeting of the heating engineers' society, will stamp that meeting as one of exceptional importance to the trade. The first is the final approval of the requirements for model compulsory heating and ventilation laws, with minimum provisions for public and semi-public buildings. This code was to be issued early in February with the sanction of the society and is intended for use throughout the country, not only in drafting proposed laws but as a general guide to the profession and to the public in connection with particular installations.

The other achievement is the society's formal action in committing itself to the project of an educational and publicity campaign as developed by a special committee. This campaign is to be conducted on two general lines, one an educational propaganda in the form of lectures, etc., and the other in the compilation of nothing less than a "heating encyclopedia." Details of this project are given in the report of the meeting on another page. They indicate an advance movement whose significance and importance will only be fully realized as the work proceeds.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Twenty-Second Annual Meeting, January, 18-20, 1916

With evidences on every side of increased strength and larger life, the twenty-second annual meeting of the American Society of Heating and Ventilating Engineers, held in New York, January 18-20, last, set new records in attendance, in the scope of its programme and in plans for future activity.

It is safe to say that no project which the society has ever undertaken approaches in importance and extent the plans which were set in motion providing for an educational course for heating engineers and systematic publicity for the heating engineer and his work. This project, which was in the hands of a special committee, was not only endorsed by the society, but was made a part of the coming year's work.

HARRY M. HART.
The New President of the American Society of Heating and Ventilating Engineers.

The plans as at present laid out provide among other things, for the preparation of a heating encyclopedia to cover all phases of the art. Matter for this encyclopedia will be accumulated as opportunity offers, and when sufficient matter is obtained it will be gone over and prepared for publication. It is the purpose to make the encyclopedia so complete and authoritative that it will serve as a standard, comprehensive work on heating and ventilation and also provide a source to which a man can come and expect to find information on any branch of the art in which he may be interested. Other plans of the committee provide for lecture courses, to be given, in some cases, before the society's chapters and in other cases before different organizations, such as men's and women's organizations in the various cities.

It is realized that there will be considerable expense connected with the undertaking, but the possibilities are considered so large and important that it is thought it will not be difficult to find ways and means to finance the plans.

Afternoon Meeting, January 18.

President D. D. Kimball called the meeting to order Tuesday afternoon in the Engineering Societies' Building. Although he did not deliver a formal address, he took advantage of the occasion to make a few remarks. The advance of the art, he said, during the past year has been more rapid than at any other period. The society, he added, is growing to proportions unthought of some years ago. The past year had, therefore, been a most encouraging one and one of the most gratifying features of the work, said Mr. Kimball, was the wide and enthusiastic participation of the members in the work. For the first

time the proceedings of the society have been printed up to date, the delivery of last year's proceedings having been made a few days before the present meeting.

Secretary J. J. Blackmore read the report of the council which showed that for the first time in the history of the society the transactions up to date have been printed and delivered. The establishment of the society's journal has been justified by the success it has been from a financial standpoint as well as adding to the prestige of the society. By means of the Journal the papers have been placed before the members well in advance of the meetings.

The society's assets now amount to $11,001, a gain of nearly $200 during the year.

The net increase in membership, it was shown, is nearly three times that of any former year, the net increase being 128.

Applications for charters from two new chapters have recently been received, one at Cleveland, to be known as the Ohio Chapter, and one at Philadelphia, to be known as the Eastern Pennsylvania Chapter.

SECRETARY'S REPORT.

The secretary's report gave some interesting figures regarding the cost of publishing the Journal. The receipts for 1915 were $9,256.05 and the disbursements $9,071.33, leaving the surplus for the year $184.72.

The treasurer's report gave details of the receipts and disbursements

FINAL REPORT ON MINIMUM VENTILATION REQUIREMENTS.

President Kimball then called for a report from the council regarding the proposed minimum ventilation requirements for public and semi-public buildings. Mr. Frank T. Chapman reported for the council that the proposed requirements submitted by last year's committee had undergone final revision. It is a document of some length and will be published in full in the April Journal of the society. Copies in pamphlet form will be available by February 1st.

An important report was then presented by M. W. Franklin, chairman of the educational and publicity committee. This committee was one appointed at the September, 1915, meeting of the society, to consider a definite plan for providing educational courses for heating and ventilating engineers.

Report of Educational and Publicity Committee.

Supplementing the general report of this committee there were sub-committee reports on scope of education, publicity and public lecture courses, ethics and welfare, and finance.

The committee, through M. W. Franklin, chairman, reported that in general the engineering professions and, accordingly, the engineers, have developed as a necessary issue of industrial activities. There were telegraph lines, for instance, before there were electrical engineers. Moreover, the first engineers were connected with manufacturing concerns. The heating and ventilating profession is experiencing the same process of evolution as that of the electrical engineers. The difficulty is that the heating engineer has not yet so far developed that he is generally known to and appreciated by the lay public as a necessary element in the industrial community.

Starting on this premise, the committee called attention to the inadequate preparedness of many entrants into the ranks of the heating and ventilating engineering profession and came to the conclusion that what is needed is an educational propaganda, professional and public, popular lectures, and an ethical campaign of newspaper publicity. The committee also recommended the preparation of a series of text-books forming an encyclopedia. This set of text-books would form the basis of instruction to be given under the direction of the society chapters. It is even proposed that graded diplomas could be given by the society certifying as to the amount of work done by the students.

A synopsis of the proposed educational course divides the subject into three parts: 1, General; 2, Heating; and (3) Ventilation. Under "General" is listed general introductory, physics and physiology. Under "Heating" is given "General," including standards

for heating buildings; heat transmission; heat losses; combustion, and chimneys; then "methods of heating," with five sub-headings covering furnace heating, radiation, hot water, steam and gas heating and electric heating. The third sub-heading takes up pipe systems, return traps and pumps, pipe coverings and insulation materials, and various special appliances. The division on "Ventilation" is divided into nine sub-headings.

The report was received by the society and its consideration carried over to a special session Thursday morning.

OPERATING PLANTS IN PUBLIC BUILDINGS.

A report made up of statistics given in the reports furnished by the Treasury Department was made by the committee on operating costs of public buildings, D. M. Quay, chairman. The first table gave quantities and costs for operating the several public buildings, while the second table showed the cubical contents, area in square feet, number of employees and the quantity of electricity used for light and power in the same buildings.

A report followed from a committee on cost of operating, heating and ventilating plants in hospital buildings, A. M. Feldman, chairman. Statistics were included covering 26 separate items for seven hospitals, five located in New York, one in Pittsburgh and one in Buffalo, N. Y. Hospital A, in New York, appeared to have the most economical plant and the committee gave what it considered to be the contributing factors which permitted this economy. Mr. Feldman stated that by mixing coal dust with buckwheat coal a great saving was made in one case in the amount used, the comparative figures being 1,351 tons for 1914, and 1,274 ton for 1915, and the comparative costs being $5,604 and $3,971.

NOMINATING COMMITTEE.

The ballot for next year's nominating committee resulted in the election of John F. Hale, W. H. Driscoll, R. W. Pryor, W. W. Macon and James A. Donnelly.

A number of proposed amendments relating to the method of electing members, etc., were also presented and ordered printed for mail ballot

The first of the professional papers was on "The Establishment of Standard Heating Elements for Cooking apparatus, with special reference to low pressure steam." This paper was part of a report of the joint educational committee presented at the 1915 meeting of the National District Heating Association, and was read by President D. S. Boyden, of that association. Details were given of tests on full-jacketed cast-iron kettles, half-jacketed cast-iron kettles, cast-iron kettles with submerged annular heating element cast in the bottom of the kettle, dish warmers, steam tables and hot water urns.

Mr. Boyden called attention to the surprising lack of data possessed by manufacturers of this type of apparatus, stating that they had little or no data as to efficient and economical operation. He urged a wider adoption of steam cooking, especially in such buildings as hospitals and similar institutions where the time factor would often permit the use of steam for cooking.

The afternoon session closed with the presentation of Prof. W. F. Verner's paper on "Cost of Opening Streets for Pipe Trenches."

Cost of Removing and Replacing Pavements.

As the tearing up of pavements in city streets is one of the principal factors to be considered in constructing a distributing system for heating, the cost per square yard, of removing and replacing the pavement is an important matter. For a sheet asphalt on 6-in. concrete, it was shown that the cost per linear foot of trench was 0.09 cents for a 22-in. trench, running up from that figure to 0.15 cents for a 41-in. trench. The same figures applied to brick on 6-in. concrete. The most expensive pavement to remove is granite block on 6-in. concrete, this cost running from 0.10 cents for a 22-in. trench to 0.16 cents for a 41-in. trench. The cheapest pavements to remove are concrete block on sand, concrete 6 in., and cobblestones on sand, all of which run practically the same at 0.03 cents for a 22-in. trench and 0.06 cents for a 41-in. trench. Cedar block on 6-in.

concrete and creosoted block on 6-in. concrete come a little below the highest figures.

In the tables giving the cost of repairing such pavements, detailed figures are given with the different items separated. The cost per lineal foot of trench runs from 0.17 cents for cobblestone on sand for a 22-in. trench to 0.75 for creosoted block on 6-in. concrete. For a 41-in. trench, the cost varies from 0.28 cents for cobblestone on sand to $1.11 on creosoted block on 6-in. concrete.

Just before adjournment a vote was taken on the applications of Cleveland and Philadelphia members for chapters of the society, to be known as the Ohio Chapter and Eastern Pennsylvania Chapter, respectively. The applications were granted by unanimous vote.

Evening Session, January 18.

The first business of the evening session was the report of the tellers on the society election. The new officers are as follows:

NEW OFFICERS.

President, Harry M. Hart, Chicago; Vice-Presidents, Frank T. Chapman, New York and Arthur K. Ohmes, New York; Treasurer, Homer Addams, New York; Council: Harry M. Hart, Chicago; Frank T. Chapman, New York; Arthur K. Ohmes, New York; Homer Addams, New York; D. D. Kimball, New York; Henry C. Meyer, Jr., New York; Dr. E. V. Hill, Chicago; Frank Irving Cooper, Boston; Walter S. Timmis, New York; C. R. Bishop, North Tonawanda, N. Y.; F. R. Still, Detroit, and W. M. Franklin, New York.

Samuel R. Lewis opened the professional session with a paper on the heating and ventilating plant of the Waite High School in Toledo, O.

Heating and Ventilating Plant, Waite High School, Toledo, O.

This paper described the equipment of the plant, with special reference to the experience gained in connection with the heating of some twenty Toledo schools. The heating and ventilating plants are combined, and no direct radiators are used except for special rooms. The fresh air enters at the second floor level, where it is tempered and then drawn down about 50 ft. to the two supply fans and by them forced through the distributing ducts. These in general are of masonry, about 8 ft. square at the beginning. Space for a future air washer is provided near the air intake, but for the present high pressure steam jets, automatically controlled, are used for humidifying. These are giving fairly satisfactory results.

At various locations convenient to the vertical flues, the distributing heating radiation is placed in plenum chambers, and the mixing damper arranged so that each flue may receive hot or tempered air. The plant may be operated as a gravity heating system when the fans are not in use. Also various apartments may be separately heated and ventilated. This is accomplished from the engine room by pneumatic control from a central indicating switchboard. The heating cost for a season was 0.931 cents per 1,000 cu. ft. of space heated, or 0.76 lbs. of coal per cubic foot of space heated per season.

In discussing the matter of calculating the cubic contents of buildings, Mr. Ehrlich suggested the term of "gross air space" and "net air space," the first including the total inside dimensions and the latter the net indoor space.

In connection with this paper a lively discussion arose over so-called Eastern and Western practice. Mr. Lewis, whose paper, he said, was an illustration of Western practice, emphasized the value of his arrangement for heating rooms with a fan blast system delivering the air first into the plenum chamber and thence to the various rooms. The particular feature, however, which he brought out was the arrangement by which, when one room came up to temperature, the radiation for that room was not shut off but served to heat the air for the other rooms. In this way it was possible, if necessary, to use the entire radiation capacity for supplying heat to a stubborn room that might at the time be difficult to heat.

Mr. Cassell, of the Philadelphia Board of Education, defended Eastern practice in using individual nests of radiators at the bases of the flues and Mr. Donnelly also expressed the view that

the advantages claimed for Western practice would be found not to outweigh Eastern methods.

J. F. Cyphers presented a paper on "Operation of Warehouse Heating Plant of Merck & Co., Rahway, N. J."

Operation of Warehouse Heating Plant of Merck & Company.

The buildings heated by the present heating plant are the main warehouse, the liquid building, the workshop building and four small sheds. The main warehouse is of slow-burning mill construction, 120 ft. wide by 650 ft. long, one story high, consisting of 21 saw-tooth sections. The liquid building is of fireproof construction throughout, of irregular shape, roughly 60 ft. x 60 ft., one story in height. The workshop building is of slow-burning mill construction, 60 ft. wide by 90 ft. long, while the four sheds have about 50 to 100 sq. ft. of radiation each, or a total of 600 sq. ft., and are heated only when in use. The total radiation in the warehouse is 17,500 sq. ft., in the liquid building, 1,200 sq. ft., and in the workshop building, 1,000 sq. ft., or a combined total of 20,300 sq. ft. The boiler plant consists of three 150-H. P. horizontal return tubular boilers, forming one and one-half batteries.

The total operating cost for a season, extending from November to May 1, was $1,778, or 0.086 cents per square foot of radiation. Estimating repairs, interest and depreciation at $2,400, the total cost of heating would be raised to $4,200. On this basis the total cost of heating per square foot of radiation was 20.3 cents per year. The actual coal burned came to 31.4 lbs. per square foot of radiation per season.

A comparison was also made with the heating system that was previously in use at this plant, the heating medium being live steam reduced from a pressure of 100 lbs. gauge. In that case the cost was found to be 31.7 cents per year per square foot of radiation. Since in either case live steam had to be used, on account of the extreme length of the building, the small difference in level between boiler room floor and warehouse floor, the large glass area in each saw tooth, the extreme exposure on every side, and the constant temperature control required, the author states his belief that the cost of operation of this heating system is exceptionally low and shows the result of the utmost care.

S. Morgan Bushnell read a paper on "Heating a Chicago Office Building," (This paper is published on another page of this issue)

Another paper on operating costs was one entitled "The Cost of Operating Heating Plants," by George W. Martin.

The Cost of Operating Heating Plants.

This paper is an elaboration of one presented on the same subject before the New York Chapter recently and summarized in THE HEATING AND VENTILATING MAGAZINE for December, 1915. One of the most interesting tables in the paper shows the cost of steam generation in a number of plants. All the plants are largely for heating, hence the load is subject to all the vagaries of the weather. These costs, which included coal, labor, ash removal, make-up water, electric current for blower, electric current for feed pumps, supplies, repairs and miscellaneous items, amounted to $0.272, $0.290, $0.275, $0.534, $0.285 and $0.279 in as many buildings. The first figure given was in connection with a 25-story office building, occupying a plot of 9,000 sq, ft. The second figure was for a large 12-story loft building, containing about 4,000,000 cu. ft. Here steam is used in large amounts for manufacturing throughout the year. The cost figure of $0.275 was for a new office building 25 stories high, with a volume of 6,500,000 cu. ft. No. 4 refers to a loft building in the old commercial section of New York. No. 5 is for a large department store of about 15,000,000 cu. ft. contents, while No. 6 is for a building that receives steam from a boiler plant 750 ft. distant.

The paper also discussed the cost of heating buildings, based on the formulas E. F. Tweedy of the New York Edison Co., and of D. S. Boyden, of the Edison Illuminating Co., of Boston. The author stated that the Boyden formula has an advantage in that it takes into consideration a difference in the operating conditions in the various buildings. Experience is necessary, however, in the use of either formula.

Morning Session, January 19.

The first paper Wednesday morning was on "Air Leakage Through Windows," by Stephen C. Voorhees and Henry C. Meyer, Jr.

Window Leakage.

The fact that few data were at hand regarding the leakage of air around hollow-metal windows was responsible for the investigations described in this paper, The tests, however, were made to include various types of windows; they covered a period of twelve months. One interesting discovery made was that there was a considerable leakage elsewhere than through the cracks between the sash and frame and between the meeting rails. It was found that the air came through the puttied joints of the glass and through the connections of the muntin bars and through the joints of the frame. Every window, therefore, was tested to determine the two classes of leakage: (1) sash perimeter, and (2) elsewhere leakage. The paper includes charts giving the results of these tests, with a description of the apparatus used. The figures for the hollow metal windows, without weather strips, were found to be quite high. For instance, at a differential pressure of 1 in. of water the leakage through some of the hollow metal windows amounted to about 10.5 cu. ft. per minute, and 1.2 cu. ft. with the weather stripped wooden window, or nearly nine times as much.

As the following paper was on a similar subject it was presented before the opening of the discussion. The paper was a report on the establishment of a standard coefficient for heat losses affected by wind movement, made by H. W. Whitten and R. C. March and first presented at the last annual meeting of the National District Heating Association.

The report embraced a study of the records of the Public Service Company of Northern Illinois for the previous two years by which it was shown that where the outdoor temperature ranges from 40° to 70° F., the wind effect is not of great importance. Below 40° it has a steadily increasing value. For instance, between 50° and 40° outdoor temperature, a wind velocity of one mile per hour is equal to 0.75° drop. For an outdoor temperature between 10° and zero, a wind velocity of one mile per hour is equal to 1.3° drop.

Mr. Davis, in discussing this report, considered that the figures for the equivalent degree drop as affected by wind movement, were higher than those that would actually be found. He also brought out the point that it was hardly practicable to take mileage and temperature, add them together and use them as a factor.

Reginald Pelham Bolton also discussed the paper, supporting the latter point, made by Mr. Davis.

F. I. Cooper stated that in installing the window frames the staff beads should be removed and the joint packed before the staff beads were again attached. This, he said, was easy to include in the specifications, but difficult to have the architect accept, because the staff beads are usually so securely fastened to the frame that their removal damages the beads.

Mr. Donnelly suggested that while the society could probably not compile a standard set of specifications, still it would be possible to adopt certain standdard clauses and that one on the proper amount of air leakage through a given window could be drawn up by the society.

Mr. Voorhees said that hollow window manufacturers are fully alive to the need of tighter hollow metal windows and are anxious to co-operate with heating engineers in this direction.

The paper on "Tests on the Recirculation of Washed Air," by G. L. Larson, was presented by Arthur K. Ohmes.

Tests on the Recirculation of Washed Air.

The tests described in this paper were made in the Wisconsin High School. This building is heated with 8,530 sq. ft. of direct radiation, with the addition of 516 sq. ft. of indirect radiation placed between the washer and the fan. The system is of the one-pipe, direct steam throughout. A fan blast system of ventilation is used, with vent ducts which carry the air back to the fan through an air washer and indirect radiators. Provision is made for admitting outside air when necessary. The best material for tracing indoor air currents was

found to be very light streamers of silk floss.

Considerable difficulty was experienced in getting the true volume of air entering the rooms. Velocity measurements were taken in all rooms, the registers being removed for the purpose.

When using recirculated water the unexpected result was obtained in that the washer supplied bacteria to the air instead of removing them, and, even when using fresh water continuously, it did not show any marked efficiency as a bacteria remover. These results are directly contrary to those obtained at the International Y. M. C. A. College, in Springfield, Mass.

The author's conclusions are:

1. The tests show that it is both unnecessary and uneconomical to supply large volumes of air to obtain good ventilation.

2. That 15 cu. ft. of air per student would be ample, providing it enters the room at a fairly high velocity and carries the proper amount of moisture.

3. With humidity ranging from 50 to 70%, the occupants of the rooms are perfectly comfortable at a temperature of 65° F., or even less.

4. With humidity of about 60%, the air can enter the rooms at a temperature of 60° without creating any discomfort; in fact, it seems to give life to the air and aids in the efficiency of ventilation.

5. Carbon dioxide content as high as 20 parts in 10,000 does not have a bad effect upon the ventilation.

6. Ventilation by recirculation is both efficient and economical. At the end of a year's run, the teachers are almost unanimous in their praise of the system.

7. With a recirculating system such as this, it requires from 40 to 50% less steam to heat the building while the fan is in operation than would be required if the air was drawn from outdoors for the same length of time.

8. Air movement keeps the temperature uniform in various parts of the room and decreases the amount of steam required for heating. The tests show a minimum saving of about 8%, due to this air movement, and this would be true whether the system is a recirculating one or otherwise.

9. The air washer absorbs a considerable amount of the carbon dioxide contained in the air passing through it.

10. The air washer is apparently quite efficient as a dust remover, but it does not remove bacteria from the air when the washer water is recirculated. The tests show that it actually supplies bacteria to the air under such conditions.

11. In spite of the poor showing of the washer, the air entering the rooms carries no more bacteria than outside air when the relative velocities in which the plates were exposed is taken into account.

Mr Palmer brought out the point that his own investigations showed that air washers do not remove odors, but that on the contrary, odors are more noticeable with high humidity.

Afternoon Session, January 18.

At the opening of the Wednesday afternoon session Arthur K. Ohmes presented a paper describing the Testing Institute for Heating and Ventilating Appliances, at the Berlin University.

Berlin University Testing Institute.

This paper contained an interesting account of the Testing Institute for heating and ventilating appliances at the Berlin University, Germany. The institute is devoted solely to the advancement of the art of heating and ventilating. While the testing of all kinds of heating and ventilating appliances is one of the main functions of the institute, the purpose is also to further the scientific education of heating and ventilating engineer and to teach the future architects the fundamental principles of heating and ventilation. There is also extensive research work done at the institute, with important results, some of which were reviewed by the author.

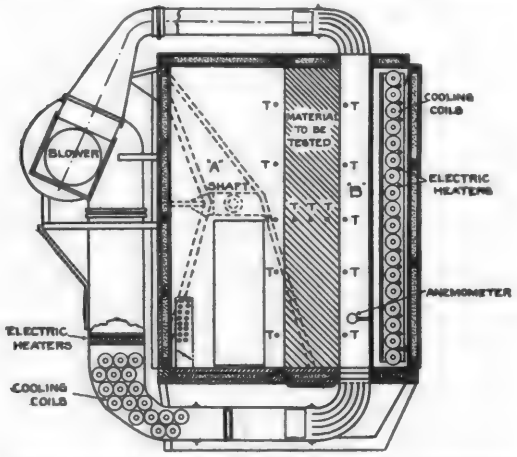
The institute was started about 20 years ago through the efforts of the late Professor Rietschel and at present occupies a building 400 ft. long, with ten testing rooms, a museum and lecture room.

Being recognized by the entire heating industry of Germany as a national institution, the seal of the institute may well "make" or "break" the successful sale of any article. For this reason many

unworthy articles coming on the market are kept off.

The author mentioned briefly some of the principal researches conducted by the institute, the results of which are published in a series of pamphlets. The cost of the pamphlets is quite low. Only our own government's publications, such as those of the Bureau of Mines, can be compared with them in cheapness and quality.

In discussing the paper Albert A. Cary contrasted European and Ameri-



PROF. BRABBEE'S METHOD OF TESTING BUILDING MATERIALS FOR HEAT TRANSMISSION AND AIR LEAKAGE.

can methods and called attention to the intensive spirit shown by the young engineers with whom he came in contact in France, Belgium and Germany. For instance, he said, they were keenly interested in the American instruments he took with him and were keen to know, not only the details of their construction, but the theories employed in their design. He expected that one of the immediate effects of the European war would be to quicken American engineers to a greater efficiency and application.

In commenting on his paper Mr. Ohmes stated that while the matter of heat transmission coefficients was as far from being definitely determined in Germany as in the United States, the Germans have one advantage in that the coefficients now in use are backed by the government so that a heating contractor cannot be sued for supplying insufficient radiation if he has used the so-called standard coefficients. The deficiency in such a case would come under the head of improper building construction.

A. M. Feldman urged the appointment of a committee to devise ways and means for establishing a similar testing station in this country.

Prof. Allen told of experiments he was now conducting at the University of Michigan which gave considerably higher coefficients than those in general use for heat losses through building materials. He stated that it took two years to calibrate the testing box. The results, he said, were so different from those of previous tests that further efforts would be made to verify them before they were published.

It was voted to appoint a committee to take up the matter further, as suggested by Mr. Feldman.

The next paper was one on "Heating and Ventilating Plant of the Equitable Building, New York."

Heating and Ventilating Plant, Equitable Building.

Details are included of the equipment of this structure, the largest office building in the world. It has a total air space of 26,000,000 cu. ft. It is heated by direct steam radiation, with a vacuum return line system, using exhaust steam from the engines, supplemented by live steam passing through a reducing valve. A 24-in. main starting at the ceiling of the 36th floor distributes steam to the various risers in the usual manner. The floors above the 36th are supplied by short up-feed risers connected to the main, and the floors from the 2nd to the 36th are supplied by down-feed risers, which generally start at 5-in. diameter and reduce to a minimum of 2-in. at the bottom. These risers are provided with expansion loops at four different levels.

The return risers start at ¾-in. in size at the top and increase to a maximum of 2½-in. at the bottom. These risers are also provided with expansion loops.

Some idea of the inmensity of the job may be gained from the fact that in the risers there are 61,000 ft. of pipe and 5,000 fittings and in the radiator branches there are 45,000 ft. of pipe and 30,000 fittings. There are 5,000 radiators throughout the building, aggregating 150,000 sq. ft. of surface.

The first floor is heated by means of a separate up-feed system, with separate supply and return mains, in order that the entire floor may be controlled independently of the balance of the building.

Twelve supply fans furnish air to the portion of the building below grade, while one fan is used to heat the main entrance and four fans supply air to the Bankers' Club, on the 38th floor. Sixteen exhaust fans are also included. In addition to the use of cheese cloth filters for the boiler room, etc., there are eight Acme air washers for purifying the air supply to other portions of the building.

The plant is now experiencing its first heating season and no operating cost data are as yet available.

In answer to a question Mr. Driscoll stated that the type of windows to be used was changed after the heating plans had been laid out. He said that an additional allowance of radiation had been made on the upper floors on the original plans and this allowance had been made in the installation.

Prof. John R. Allen presented a paper on "Heat Analysis of a Hot-Air Furnace."

Heat Analysis of a Hot Air Furnace.

In this paper are given the results of tests made to determine the distribution of heat in a hot air furnace and to find the constant of heat transmission for the heating surfaces. The air quantities supplied by the furnace were measured by an anemometer in the center of each pipe at the top. There were also recording thermometers to give the temperature of the outlet air. The humidity of the air was found by using a stationary wet and dry bulb thermometer at the exit. Other records included the temperature of the gases over the fire, the pyrometer used for this purpose having a couple protected from direct radiation by inserting it in a bowl of a porcelain cup, well lined with asbestos. The temperature in the top of the flues was also measured with a pyrometer and in the furnace radiator a high-reading mercury thermometer was used, placed in mercury wells. In the breeching casing the recording thermometer was checked with a mercury thermometer inserted in a mercury well. There was also a CO_2 recorder, a recording draft gauge and platform scales.

Two series of tests were run, one with mixed nut and anthracite and the other with gas coke. Results are given of six successful tests, showing that the efficincy of this hot air furnace to be high. The combustion was good, equalling that of the modern cast-iron steam boiler, and the temperature of the stack gases was not unduly high. The co-efficient of heat transmission as found from these tests is lower than that obtained in cast-iron house heating boilers. This is only an apparent constant, as it is impossible to determine the quantity of heat received by the surfaces from the direct radiation of heat from the fire.

Frank N. Speller then presented a paper on "The Prevention of Corrosion in Pipe." This paper supplemented other papers by the same author on the relative corrosion of steel and wrought iron pipe. He said there had been a great deal of discussion of the matter of corrosion, but little had been said about prevention methods.

The conclusions reached in the paper were that it appears from present experience that developments in the metallurgy and manufacture of steel pipe promise to add 50 per cent. or perhaps 100 per cent. to the life of pipe compared with the service obtained under like conditions ten or twelve years ago. It is possible to predict that de-aeration of the water through the use of plants designed with this end in view should at moderate expense increase the life of some piping systems four or five times. Mr. Speller accompanied his paper with a number of lantern slides illustrating in greater detail the points brought up in his paper, including typical installations.

Morning Session, January 20.

This was a special session, not on the regular programme, for the purpose of considering the proposed plan to commit the society to a project of education and publicity, including the preparation of lecture course and the publication of a society text-book, which will constitute a heating and ventilating encyclopedia.

M. W. Franklin, chairman of the committee having this matter in charge, reviewed the rise of the engineering profession, stating that civil, mechanical,

electric, mining and chemical engineers are now on an equal plan with the lawyer, doctor and men of similar professions.

He also pointed out that natural evolution is slow and that the choice was before the society of taking effective steps now to make the heating art one of the recognized learned professions, or to let it reach that plane by natural growth. In either event, he said, he foresaw such an evolution.

At the same time it was highly desirable, he said, that the profession have some guides which might serve as general standards in the way of engineering data. In other words, while it was not possible to say the last word in heating and ventilating engineering it was feasible to say the first word.

Professors Kent, Allen and Carpenter all spoke in favor of the plan. Professor Kent estimated that the cost of a comprehensive text-book would run up to $20,000. Prof. Carpenter referred to the activities of the automobile manufacturers and stated that they started out to compile a text-book, and while the plans were not carried out exactly as planned, it did result in the development of standards as to parts and accessories that have proved most valuable to the automobile trade.

Dr. E. V. Hill, head of the ventilation division of the Chicago Department of Ventilation, urged the appointment of an editor-in-chief to have charge of a society text-book, to be employed by the society, and to devote his whole time to the project.

It was finally voted to adopt the report of the committee and continue same to work in co-operation with the council of the society towards the furtherance of the general plan, as outlined in the report.

Afternoon Session, January 20.

A paper by Secretary J. J. Blackmore opened the Thursday afternoon session with a paper entitled "Can We Standardize the Requirements of Ventilation?"

Can We Standardize the Requirements for Ventilation?

Mr. Blackmore has here assembled a comprehensive and very readable summary of present-day thought on the subject of ventilation, with special reference to the developments of the last few years. All of the important theories that have come up recently are included, and the conclusion is reached that a thorough diffusion and a constant movement of the air in the rooms of our buildings is the most important factor in the production of good ventilation, and that if the location of the fresh air inlets by which fresh air is delivered to rooms is such that the current does not reach every part of the room, such rooms should be provided with desk fans, or fans of some other type, so placed that they will insure absolute diffusion and continuous movement of the fresh air to all parts of the room.

In connection with a study of the outdoor relative humidity conditions, the author presents tables covering the records for the year 1914 in four cities, three of which are widely separated. The Chicago figures, for instance, showed that the highest mean relative humidity for the winter was 81 per cent. and the lowest 54 per cent. In Burlington, Vt., the highest was 83 per cent. and the lowest 58 per cent. In Springfield, Ill., the highest was 87 per cent. and the lowest 54 per cent., while in Fresno, Cal., the highest was 92 per cent. and the lowest 33 per cent. The varying times at which these high and lows occurred led the author to state that, while we should have no trouble in ascertaining what is the best relative humidity, the figures show that we are accustomed to considerable fluctuations. He adds that it is probably in respect to humidity that we have gone to extremes in producing artificial conditions, greatly to the detriment of our physical welfare.

Dr. E. V. Hill, in opening the discussion, submitted a set of standards for ventilation in actual use by the Chicago division of ventilation. These were: Air supply, 30 cu. ft. per minute per person; air movement, 2½ ft. per second; parts of CO_2 in 10,000, 8 parts; temperature, degrees F., 68; relative humidity, 42 per cent.; dust count, 100,000 particles per cubic centimeter; bacteria, 12 colonies per plate.

A paper was then presented on "Ventilation of Homes," by the Chicago Commission on Ventilation.

Ventilation of Living Quarters.

The ideas brought out in this paper are based on the proposition that the conditions of a spring day outdoors, with sunshine and a cool breeze, should be approximated as nearly as possible indoors. Studies are included of the air currents in four residences. Drawings of the houses are given, showing the air currents and setting forth the pertinent temperature, moisture and wind conditions, both indoors and out. The air currents were traced by watching smoke from burning Chinese punk placed in various parts of the rooms and in the different openings and also by the use of fine ravelings of silk floss.

Following are the conclusions reached:

1. The effect of the direction of the wind outside is very much influenced in its relation to the currents inside of a house by the local conditions of the adjacent buildings and obstructions and by the house itself.

2. Air currents as a general rule seek the easiest way in and out of a house.

3. The more inlets there are open on the side facing the wind the better the ventilation, provided there are openings on the leeward side.

4. Adequately to ventilate a home requires sufficient inlet and outlet openings.

5. The efficiency of ventilation increases with any increase in the difference between the temperatures indoors and outdoors.

6. Better results are usually possible when ventilating the entire house than when ventilating only one room.

7. Proper distribution of fresh air is more difficult to attain than proper volume. Part of a room may receive good ventilation, while other parts are stagnant.

8. Furniture exerts a material influence on air currents, and conditions may be improved by intelligent placing of the furniture.

9. Eddies tend to form wherever the air currents are blocked.

10. The distribution of the air is best obtained by proper distribution of the inlets and outlets.

11. An open stairway tends to cause a current of air to rise through it, even though the windows may be closed.

12. An open shaft, like a large chimney centrally placed, would assist materially in ventilating a house.

The commission comes out as a strong advocate of the use of electric fans in households, not only to create currents of air in the directions desired, but for use in blowing air over radiators to increase the amount of heat given off. Artificial moisture introduction is also recommended, either through the use of water pans or, where steam heating is installed, through the admission of steam direct to the air.

It was explained by Mr. Lewis that the houses in which the tests were made had all the windows wide open during the tests. The tests were made in the summer time.

The concluding paper was "An Outline of the Activities of the New York State Commission on Ventilation for the Year 1915." During the past year certain of the studies on temperature and stale air have been repeated. In addition to this, studies have been made on (1) the relation of heat and cold to respiratory efects, (2) the influence of humidity on comfort and mental work, (3) methods of determining the dust content of air, (4) the comparative effects of different types of natural and mechanical ventilation on comfort, mental efficiency and physical condition, (5) the course taken by air currents in a fan ventilated room. As much of the work is being reported for verification, no broad conclusions were presented.

Frank T. Chapman opened the discussion and proposed a resolution expressing the appreciation of the society to the New York State Commission on Ventilation for the account of its work and also its gratification to have it brought out that the accepted ventilation standards are confirmed from a physical standpoint, as well as from a purity standpoint.

Mr. Chapman called special attention to the suggestion brought out in the paper that square feet of floor space per 100 lbs. of flesh is a much more instructive figure than square feet of floor space per person. Heat and respired air output vary closely with a person's weight. The average child of the first grade, it was stated in the report, weighs 49 lbs.,

whereas eighth grade pupils weigh 100 lbs. Dr. E. V. Hill also endorsed this method of figuring requirements and results.

The new president, Harry M. Hart, was then installed by the retiring president, D. D. Kimball. President Hart called Vice-Presidents Frank T. Chapman and Arthur K. Ohmes to the rostrum and each acknowledged the honor done them and their interest in the society's progress. Treasurer Homer Addams and the council members present were also duly installed.

The meeting then adjourned.

Heating Engineers' Dinner.

Following the custom established last year, the annual banquet of the heating engineers' society took the form of a dinner dance. It was held in the Belvidere Room of the Hotel Astor on Wednesday evening, the second day of the meeting, and was attended by some 175 guests. The diners were seated at individual tables, a space for dancing being left in the center of the room.

Most of the guests were primed for the surprise presentation which had been arranged in honor of Frank K. Chew, long an active member of the society, which was to take the form of a loving cup, a bound volume of testimonial letters and a set of the new edition of the Encyclopedia Britannica.

Before this happened, however, the program called for a toast to "The Old Year," which was responded to by President D. D. Kimball, who also acted as toastmaster Mr. Kimball said the spirit of co-operation shown by the members was the most important item of the old year and he referred to the way this was shown in the work of the various committees.

He then called upon the president-elect, H. M. Hart, who spoke to the toast, "The New Year." Mr. Hart said the standard set by the retiring administration would be hard to maintain. The society had had a wonderful year of activity, but the various projects were so well advanced that there was the highest encouragement in the outlook for his term of office. He reminded his hearers that the society is for the benefit of the members, and not the members for the benefit of the society, and it was essential that it be conducted for the greatest good of the members.

To Percival H. Seward had been assigned the duty of making the surprise presentation to Mr. Chew. His subject was the innocent-looking toast, "Loyalty to the Society Personified." Mr. Seward spoke first of the necessity of members being prepared to do their duty in the society and then he declared that the society had a type of a man who was not only so prepared, but who had for many years furnished an example as an effective worker.

As he mentioned the name of "Frank Chew," the diners burst into applause which

LOVING CUP PRESENTED TO FRANK K. CHEW.

was only equalled by their appreciation of the surprise evident on the part of Mr. Chew.

The loving cup which Mr. Seward then presented to Mr. Chew bore the inscription: "To Frank K. Chew, a token of 21 years of unremitting service with the American Society of Heating and Ventilating Engineers, January 19, 1916."

In accepting the gifts, Mr. Chew, after expressing his thanks and appreciation, jokingly warned the members that if the presentation was intended to retire him as a worker there was a surprise in store for the members, as the loving cup would be an inspiration to him to renewed effort in the society's interests.

Dr. D. S. Jacobus, president of the American Society of Mechanical Engineers, was then introduced and was warmly greeted. Dr. Jacobus declared that this is the day of the engineer, who is rapidly coming into his own. He also spoke of the tendency towards standardization in engineering work and urged a closer co-operation on the part of engineering societies to further standardization of practice and materials. He referred to the success achieved in this direction with respect to automobile accessories and pledged the mechanical engineers' society towards co-operation with the heating engineers' society in every way possible.

The concluding toast was "Getting Together," the speaker being Albert E. Roberts. Mr. Roberts presented in an eloquent manner the high ideals of brotherhood which were coming to be recognized as a vital principle of human activity. The war now raging in Europe, he said, was a terrible object lesson of the need of this great ideal. On our children, said Mr. Roberts, would devolve the great task of helping to mend the bitterness that would long outlast the war itself, and whatever our field of activity, whether engineering or some other field, the great duty of the present generation was to develop a spirit of closer and more practical co-operation, not only for our own benefit, but as an inspiration to the coming generation.

This concluded the speech-making, and the remainder of the evening was given over to dancing.

Diversions for the Ladies.

While the men were engaged at the professional sessions of the meeting, the ladies were being entertained by a committee composed of J. I. Lyle, chairman; Douglas Sprague, G. G. Schmidt, B. K. Strader, R. W. Pryor, N. L. Schloss, H. G. Issertel and J. Barton Garfield. On the first day of the meeting Mr. Lyle was suddenly called away by the news that his home in Plainfield, N. J., was in flames. The fire, it was learned, had started at about 10 P. M., and while the family had retired, there were. fortunately, no fatalities. The house itself, however, was badly damaged by flames and water. Many expressions of sympathy were expressed to Mr. Lyle over his misfortune.

The principal events for the ladies were a trip to the Metropolitan Museum of Art, Tuesday afternoon, a visit to the Biltmore Ice Gardens for open air skating, on the roof of the Biltmore Hotel, Wednesday afternoon, and a matinee party at the Hippodrome, Thursday afternoon. Here the attraction was "Hip, Hip, Hooray," with Sousa's Band and the ice ballet.

Byron T. Gifford Addresses Illinois Chapter on "Central Station Heating."

A review of central station practice and the promising outlook for this industry were features of an address delivered before the Illinois Chapter at its January meeting, January 10, by Byron T. Gifford, chief engineer of the American Public Utilities Co., Grand Rapids, Mich. Mr. Gifford is the author of the well-known work, "Central Station Heating," and his remarks were based on a wide experience in this field. He stated that there are about 400 central station heating plants in the United States and he brought out the fact, perhaps not generally known, that the largest plant of this kind is that of the New York Steam Company, in New York.

Mr. Gifford gave some particulars of the plants in La Crosse, Wis., and in Indianapolis, and declared that the business may be taken up profitably, especially in towns of 10,000 population and over. In Indiana, where this type of heating has developed rapidly, there is some $7,000,000 invested in central heating systems.

Methods of overcoming leaks from underground mains were discussed, one method being the welding of joints. It is also becoming the practice to increase the metal at the rib approximately 33 1/3%.

In the case of the La Crosse plant, changes in the underground heating mains had resulted in reducing the hot water temperature drop from 4° to 2° F. in a circuit of 14½ blocks.

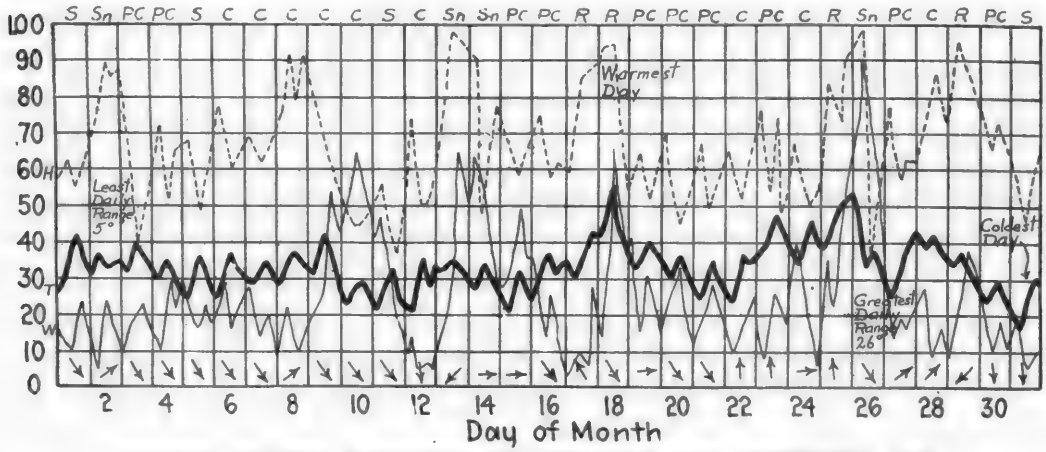
He said a safe rule in central station operation was to limit the distance for transmitting steam or hot water to ten blocks from the plant. In Indianapolis, the longest carry for the steam is 6,200 ft.

Mr. Gifford emphasized the urgent need of a hot water B.T.U. meter that would measure the heat in the outgoing and incoming flow of water in central hot water heating plants.

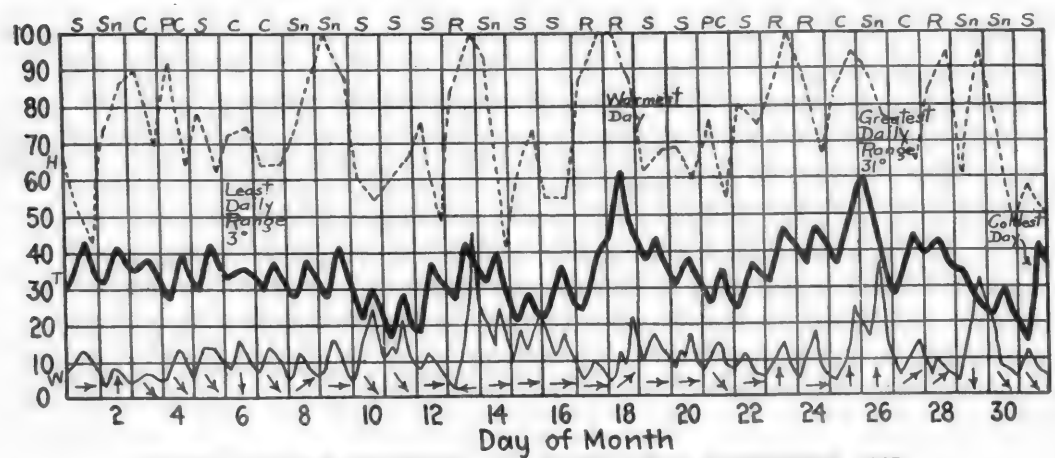
The meeting followed a chapter dinner at the Hotel Morrison, Chicago, and was attended by thirty members, President E. L. Hogan being in the chair. It was announced that the February meeting will be addressed by Secretary J. J. Blackmore, of the American Society of Heating and Ventilating Engineers. This meeting will be held February 14. The principal speaker at the March meeting will be J. T. Seeley, assistant manager of the Chicago Elevated Railways.

The Weather for December, 1915

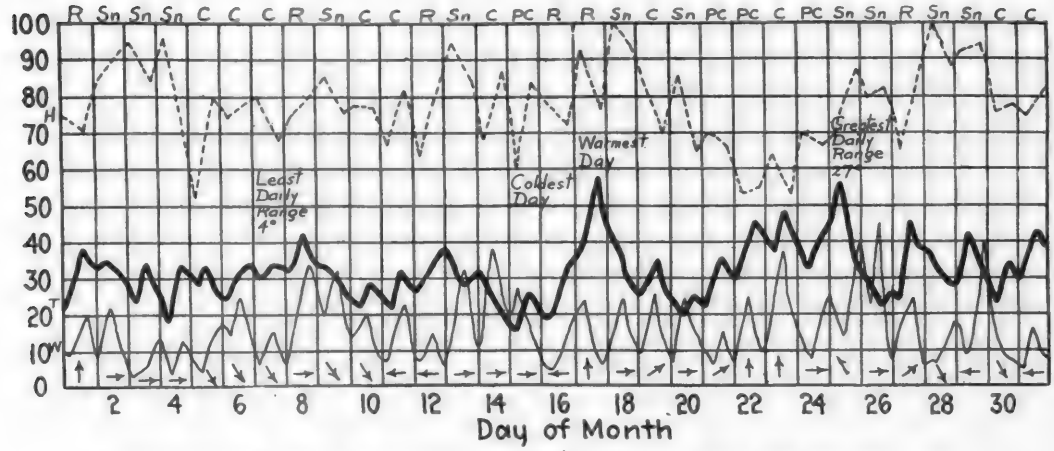
	New York.	Boston.	Pittsburgh.	Chicago.	St. Louis.
Highest temperature, degrees F	55	61	58	42	56
Date of highest temperature	18th	18th	17th	23d	22d
Lowest temperature, degrees F	17	16	16	8	12
Date of lowest temperature	31st	31st	15th	20th	28th
Greatest daily range, degrees F	26	31	27	19	22
Date of greatest daily range	26th	26th	25th	15th	26th
Least daily range, degrees F	5	3	4	3	3
Date of least daily range	2d	6th	7th	9th	12th
Normal temperature for month, degrees F	33.5	34.6	32	29.1	35.4
Normal mean temperature for month, deg. F.	34.5	31.6	34.7	29.3	35.5
Total rainfall, inches	2.23	3.94	3.85	1.31	3.34
Total snowfall, inches	8.1	6.7	8	9.2	13
Normal precipitation this month, inches	3.43	3.4	2.73	2.07	2.23
Total wind movement, miles	15,885	8,849	9,514	9,302	9,430
Average hourly wind velocity, miles	21.4	11.9	12.8	12.5	12.7
Prevailing direction of wind	N.W.	W.	W.	W.	N.W.
Number of clear days	4	13	0	5	9
Number of partly cloudy days	12	4	5	9	8
Number of cloudy days	15	14	26	17	14
Number of days on which rain fell	12	12	17	13	9
Number of days on which snow fell	4	7	11	8	3
Snow on ground at end of month, inches	..	4	..	0.3	3



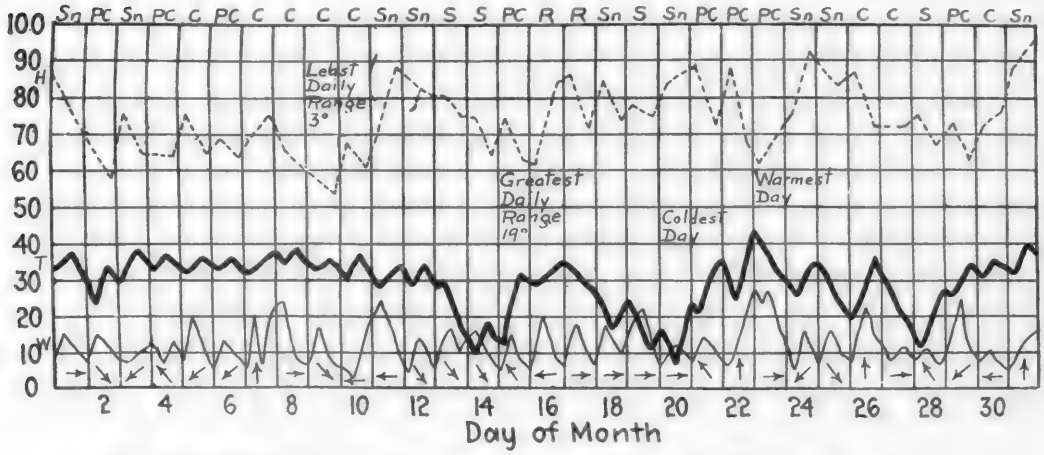
RECORD OF THE WEATHER IN NEW YORK FOR DECEMBER, 1915.
(Hourly Readings of the Relative Humidity Are Plotted on This Chart.)



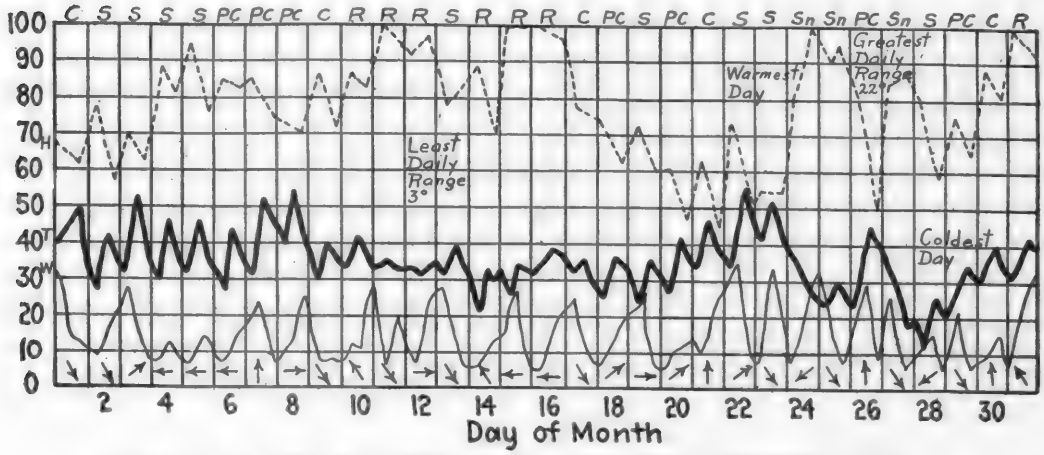
RECORD OF THE WEATHER IN BOSTON FOR DECEMBER, 1915.



RECORD OF THE WEATHER IN PITTSBURGH FOR DECEMBER, 1915.



RECORD OF THE WEATHER IN CHICAGO FOR DECEMBER, 1915.



RECORD OF THE WEATHER IN ST. LOUIS FOR DECEMBER, 1915.

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.

Heavy lines indicate temperature in degrees F.

Light lines indicate wind in miles per hour.

Broken lines indicate relative humidity in percentage from readings taken at 8 A. M. and 8 P M.

S—clear, P C—partly cloudy, C—cloudy, R—rain, Sn—snow.

Arrows fly with prevailing direction of wind.

New Heating and Ventilating Requirements for Public School Buildings in Illinois

Notable amendments to the Illinois School Law, which were passed at the last session of the Illinois legislature, materially affect the requirements for the heating and ventilation of public school buildings in that state, as well as the lighting, seating, water supply, toilets and safety against fire in the public schools. Attention is called to the fact that in the case of new or remodeled buildings the law goes into effect at once. But for buildings already in use the penalties cannot be enforced until March 1, 1917. School officers are advised to begin at once and do what can best be done now. By March 1, 1917, they must be able to meet all the requirements of the law.

THE NEW LAW.

The requirements in question are contained in Sections 3, 15, 35 and 114-119 of the "School Law Relating to the Sanitary Conditions of School Buildings." The extracts mentioned as well as the specifications for the minimum requirements for heating, ventilation, etc., are published as "Circular No. 88" by F. G. Blair, state superintendent of public instruction.

Section 3, Paragraph 13, states that it is "the duty of the superintendent of public instruction to prepare, with the advice of the State Board of Health, the state architect and the state fire marshal, for school directors and boards of education, specifications for the minimum requirements for the heating, ventilation * * * which will conserve the health and safety of the children attending the public schools."

Under Section 15, devoted to the "duty of the county superintendent of schools," it is stated that "the duty of the county superintendent of schools shall be to inspect the plans and specifications for the heating, ventilation, lighting, seating, water supply, toilets and safety against fire for public schoolrooms and buildings submitted to him by boards of education or boards of directors, and to approve all those which comply substantially with the specifications prepared and published by the superintendent of public instruction."

Also "to inspect all public schools under his supervision and notify in writing before the first day of April the board of school trustees, or other boards exercising similar functions, whether the several schools in their jurisdiction have or have not been kept as required by law."

Provision is made for the condemnation of such buildings if they are found not to come up to the requirements in any way. There is also a clause which provides for the withholding of the part of the distributive funds apportioned to the various school districts in cases where the requirements are not met.

Regarding the submission of plans, it is specified in Sections 114-119 that "before erecting or remodeling a public school building the board of directors or the board of education in districts containing fewer than 100,000 inhabitants shall submit plans and specifications respecting heating, ventilation, etc., to the county superintendent for his approval.

MINIMUM REQUIREMENTS.

Acting under the law, Francis G. Blair, state superintendent of public schools, has made out a set of standard minimum requirements, the principal items of which are given herewith:

ROOM HEATERS AND VENTILATORS.

In connection with the requirements where room heaters are used, it is provided that the cross-sectional area of the opening into the foul air vent shall be equal to that of the cross-sectional area of the fresh air opening. All classrooms must have at least 16 sq. ft. of floor space and not less than 200 cu. ft. of air space per pupil.

FRESH AIR DUCTS AND VENT FLUES.

A. When the foul air is taken out through the smoke flue:

	Cubic Feet in Room		
	8,000 or less. Sq. in.	8,000 to 12,000. Sq. in.	12,000 to 16,000. Sq. in.
Cross-sectional area of smoke flue not less than	192	256	400
Cross-sectional area of foul air vent into chimney not less than	144	216	320
Cross-sectional area of fresh air intake not less than	144	216	320

B. When the foul air is taken out through a flue separate from the smoke flue:

	Cubic Feet in Room		
	8,000 or less. Sq. in.	8,000 to 12,000. Sq. in.	12,000 to 16,000. Sq. in.
Cross-sectional area of smoke flue not less than	81	144	216
Cross-sectional area of foul air vent flue not less than	192.	256	288
Cross-sectional area of fresh air intake not less than	192	256	288

The cross-sectional area of the vent flue shall be at least equal to the openings specified above.

BASEMENT HOT AIR FURNACES.

When a basement furnace is used there shall be an intake for fresh air from outside the building and also a cold air intake from inside the schoolroom. Dampers shall be provided which will make it possible to take all the air from one source or to take a part from both sources at the same time.

The chains which regulate the dampers for the admission of air to the furnace and those which control the drafts of the furnace shall extend into the schoolroom.

There shall be an entrance to the basement from within the building as well as from without.

The floor of the basement shall be concrete or brick.

Warm air from the furnace shall be admitted into the room at the wall at least 6 ft. above the floor.

The opening into the foul air flue shall be at the floor level and the foul air flue shall be so constructed that it will be heated by the smoke flue.

The return cold air opening from the room as well as the opening from the outside shall be at the same wall as the warm air inlet and shall be 2 in. above the floor level. The grating over this opening shall be leaned against the wall at an angle of 45°. The openings from the outside and the inside shall connect with the duct to the furnace. The damper shall be constructed so as to close either opening and leave the other open.

A foot warmer or warm air register shall be placed at the floor level in the wall. No warm or cold air register shall be placed in the floor where it can be walked on or sweepings fall into it.

STEAM HEATING.

The Fan System—When the fan system of ventilation is used, the warm air flues shall have a cross-sectional area of not less than 9 sq. in. for each occupant of the room. The vent flues shall have a cross-sectional area of not less than 10 sq. in. for each occupant of the room.

The Gravity System—Where the gravity system of ventilation is used the warm air flues shall have a cross-sectional area of not less than 16 sq. in. and the vent flues 14 sq. in. for each occupant of the room.

Air Passed Through Radiators—When fresh air is taken directly into the room and passed through the radiators, the combined cross-sectional area of all the openings shall be not less than 9 sq. in. and that of the vent flue not less than 10 sq. in. for each occupant of the room.

When the methods mentioned in the last two paragraphs are used, each foul air flue shall be provided with a radiator of at least 9 sq. ft. of radiating surface.

Moistening the Air—In all systems of heating ample provision shall be made to moisten the heated air.

The county superintendents will be called on to fill out a definite report covering some fifty separate items, including measurement of the floor space, cubical contents, window space, sizes of ventilating flues, etc. After his inspection, he is to be provided with a score card which he is to fill out, showing the points that are unsatisfactory as well as his suggestions for improving them.

LEGAL DECISIONS

Assignability of Heating Contract.

A contract between a company and a consumer bound the company to furnish to the consumer, its successor or assigns, to certain specified premises, all electric service for lighting, fans, and heating required by the consumer, and the consumer agreed to pay therefor. The consumer sold its business and assigned the contract to the buyer. The company refused to supply the buyer with electricity at the rate stipulated in the seller's contract, claiming that the contract was not assignable. It was held that the contract did not create obligations personal in such a sense as to render the contract nonassignable within the rule that when rights arising out of contracts are coupled with obligations to be performed by the contractor and involve such a relation of confidence that it must have been intended that the rights should be exercised and the obligations performed by him alone, the contract, including both his rights and obligations, cannot be assigned without the consent of the other party. Here there was nothing on either part calling for the exercise of personal service. The contract was on a printed form, and contained printed stipulations on the black, concluding with the following: "This agreement is not transferable." It was held that this did not render the contract non-assignable, being repugnant to the agreement to supply the consumer, his successors or assigns, and the first provision would control, especially as the stipulation was not in the face of the contract, but printed on the back. The court cited the case of Voigt vs. Murphy Heating Co., 164 Mich. 539. The owner of a large office building had a contract with a company furnishing steam from a

central plant for heating purposes. He sold the building and assigned in writing the heating contract. The heating company sent the purchaser a duplicate of the original heating contract, with the exception that the rate was higher. The parties could not agree. It was held that the heating contract was assignable, and passed, with all its benefits and privileges, to the purchaser by virtue of the assignment. Leader Co. vs. Little Rock Ry. & Electric Co., Arkansas Supreme Court, 179 S. W. 358.

Failure to Heat Premises—Tenant's Remedy.

Action was brought by a tenant against a landlord to recover sums expended in heating the leased premises, due to the landlord's failure and refusal to furnish heat, when the plaintiff's lease required that the lessor should furnish "steam heat when necessary, from October 1 to April 30, for ten hours per diem." The Illinois Appellate Court held that if a lessor fails to furnish heat as stipulated in a lease, the tenant may recoup the cost from the rent or sue upon the covenant. The plaintiff was held entitled to prove the failure to furnish heat, and testimony as to temperature was admissible. Globe Association vs. Briggs, 190 Ill. App. 60.

Contract for Sale of Ventilating Fan—Rescission.

In an action to recover the price of a ventilating fan installed in the defendant's mine, it appeared that two weeks prior to the delivery of the fan the plaintiff, on looking over the specifications of the fan, found that they did not fit the conditions of the mine, and concluded there ought to be a change in one of the dimensions as set forth in the agreement; that, instead of having the fan 48 in. in diameter by 32 in. wide, they would have better results if the fan were reduced to 27 in. in width. He notified the defendant of this; the defendant made no reply. The defendant accepted the fan, and used it for one year and nine months, after a defect in the installation had been remedied by the plaintiff. It was held that the plaintiff was entitled to recover the whole contract price, as there was no evidence of a rescission of the contract, or an offer to return the fan, or any testimony from which a jury could fix with any degree of certainty any damages sustained by the defendant.

Where there has been substantial and bona fide performance of an entire contract, but failure in some particulars not essential to the enjoyment of the part performed, there may be a recovery of the contract price subject to the right of the defendant to set off damages resulting from the breach, but if there is no evidence of such damages, there can be no set off. Where a party discovers facts, which warrant rescission of his contract, it is his duty to act promptly, and in case he elects to rescind, to notify the other party without delay. What is a reasonable time or undue delay when the facts are undisputed, is a questions of law to be determined by the court. Robinson vs. Listonburg Coal Mining Co., 58 Pa. Superior Court, 136.

Fumes from Gas Water Heater.

Action was brought by a landlord against a tenant to recover damages resulting from the presence of gas fumes in a bathroom from the use of a gas water heater without a proper vent pipe connection. It was held that an allegation that the tenant did not know the danger of using a water heater did not show that the tenant had a right to rely on the existence of a vent pipe or connection therewith, and stated nothing for which the landlord was responsible. The declaration failed to disclose any defect in the vent pipe, or, if one, that it was concealed, or that knowedge of it was chargeabe to the landlord, or that it was not discoverable or ascertainable by the tenant. It was held to lack the elements essential to such a cause of action. Gathemann vs. Rosenfeld, 190 Ill. App., 110.

Contamination of Air by Automobile Exhausts.

A new disease, which has been classified as petromortis, has been found to lurk in the exhaust of automobiles, according to Dr. George L. Apfelbach, of the staff of the Illinois state factory inspector. Dr. Apfelbach has just prepared a study of the poisonous effects of the exhaust gas from gasoline cars which will appear in the forthcoming report of the state factory inspector. His experiments have led to the conclusion that petromortis, first brought to public notice by the death of Attorney Eugene M. Bumphrey, in Chicago, is principally due to carbon dioxide gas.

HEADACHES FROM GAS.

"The exhaust gas is rapidly diffused on the street or in the open," Dr. Apfelbach says in his report. "Nevertheless, we occasionally hear of cases of mild nausea and headache having occurred in the crowded downtown districts in the large cities on rainy days. The condi-

tion, however, becomes quite serious if the motor is allowed to run in a closed garage.

"Investigation was made by interviewing chauffeurs of five taxicab companies in Chicago and by obtaining information first hand from a physician who spends one hour every day in the main garage of such a concern. The medical man stated that he frequently hears that mechanics and chauffeurs complain of vertigo, headache and nausea, especially in the winter months and on rainy days."

CONTAINS NO HYDROGEN.

With the assistance of Joseph A. Schumacher, of the city gas bureau, Dr. Apfelbach analyzed the exhaust from fourteen motor cars, with the following result:

Content.	Per cent.
Carbon dioxide	6.7
Carbon monoxide	9.3
Oxygen	1.4
Illuminants	.3
Nitrogen	82.2
Hydrogen	0.0

Dr. Apfelbach's conclusions follow:

1. The exhaust of autos contains a very toxic gas, the carbon monoxide content being over 9%.

2. Since the gas is so toxic, the public should be warned. No motor should be allowed to run in any garage unless the ventilation be extraordinarily good. To go alone into any garage where a gasoline motor is running is entirely incompatible with the present day slogan of "safety first."

3. The chief inspector has instructed all deputies to prohibit the emptying into any workshop of any stationary gasoline engine exhaust. The "health, safety and comfort law" provides for this supervision.

DIFFERS WITH DR. ELLIS.

Dr. Apfelbach took issue with Dr. John D. Ellis, head of the department of educational diseases, Rush Medical College, who declared the toxic elements of the gasoline fumes were splitting products of benzine.

"Benzine is distilled from gasoline, so there would be practically no benzine fumes in the exhaust of a car," Dr. D. Apfelbach said. "Our experiments showed no decidedly poisonous gases with the exception of carbon monoxide. But the amount is so large that running a motor 15 minutes in a closed room might be fatal. In fatal mine accidents 1.7% carbon monoxide has produced death."

Proposal to Abolish Fahrenheit Scale in Government Publications.

A bill has been introduced in Congress to abolish the Fahrenheit thermometer scale, now in general use in this country, and substitute for it the Centigrade scale as the standard in United States Government publications. In order to obtain an expression of opinion as to the effect such a change would have on commercial and other activities, the New York office of the United States Weather Bureau is sending out a question sheet to those interested with a view of ascertaining the general opinion on the matter.

Pipe Symbol Chart.

By T. W. Reynolds.

The symbols shown on the accompanying pipe symbol chart are more for general use in piping work and are significant of the meaning they are intended to convey. Some engineering offices differ slightly in the type of symbols used and those given in the chart are suggestive only.

Symbols other than those for pipe should be drawn in size nearly equal to that of the actual space on the scale occupied by the article so symbolized.

The use of colors on the tracings aids in the ready determination of the piping runs, fittings, etc. Similarly the black lines show up much more distinctly upon the prints than do the other colors.

The piping around traps could be omitted, if desired, and merely an outline of the trap shown. In any event, a typical detail of connections at traps should be shown, to serve for all traps of the type indicated.

Sampling and Analyzing Flue Gases.

As the analysis of flue gases tends to develop better methods of firing, which in turn reduces waste of fuel, the Bureau of Mines, Department of the Interior, in Bulletin 97, "Sampling and Analyzing Flue Gases," by Henry Kreisinger, engineer, and F. K. Orvitz, assistant chemist, just issued, presents for the benefit of those in charge of boiler plants and all other persons interested detailed information on methods of sampling and analyzing flue gases, and on the utilization of the analyses in promoting boiler-room economy.

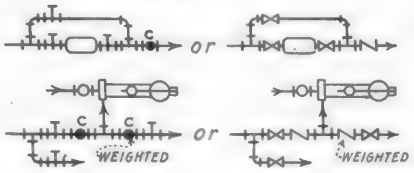
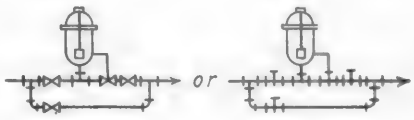
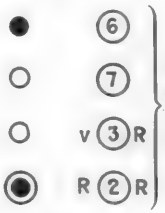
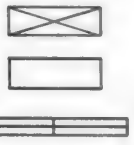
Cost of Operating Electric Fan Over Radiator.

When the outside temperature is between 4° and 35° F., an electric fan placed behind the radiator in a room will increase the comfort of the room and make it possible to use all parts of it. With coal at $4.00 a ton, the average saving on coal needed amounts to 6.4 cents a day. The cost of electricity to drive the fan at 6 cents per kilowatt is 4.6 cents. There is, therefore, a saving of 1.8 cents, in addition to the added comfort.—*Electrical World.*

PIPE SYMBOL CHART

Symbol	Description	Color	Remarks
Pipes	L P Steam	Red	All Fittings shown in Black
	H P Steam		
	H P Exhaust		
	Return	Blue	
	L P Drip	Red	
	H P Drip	Green	
	Vapor or Vent	Black	
	Blow-Off		
	Cold Water	Orange	
	Hot Water Supply		
	Hot Water Return		
	Soil and Waste	Black-Heavy	
	Vent (Plumbing)		
	Refrigeration	Green	
	Vacuum Cleaning		
	Present Piping to be removed	Black-Green Cross Lines	
	Gate Valve		Black-Lines colored as given under Pipes
	Check Valve		
	H.P Valve with By-Pass		
	Automatic Diaphragm Valve	Temperature Control System	
	Vacuum Return Valve		
	Blow-Off Cock		
	Back Pressure Valve	First-Lever Type / Second Diaphragm Type	
	Pressure Reducing Valve		
	Plugged Tee		

PIPE SYMBOL CHART
(CONTINUED)

Symbol	Description	Color	Remarks
	H. or L. P. Trap (Bucket Type) Tilting Trap (Bundy)		Black-Lines colored as given under Pipes
	Tilting Trap (Crane Tilt Non-Return) Tilting Trap (Crane Tilt Lifting)	Black	
	Anchor		
	Thermostat	Black	
	Vacuum Cleaning Outlet	Black	
	Water Level Trap	Black	
	Steam Riser Return Riser Vacuum Cleaning Riser Refrigeration Riser	Red Blue Black Numbers in Green Circles Black Letters	Black No's in Black circles Numerals within circles as required Large Circles 1/4" diameter
	First Floor Radiator Connection - Supply	Red	
	First Floor Radiator Connection - Return	Blue	
	Plan: Radiator Plan: Radiator (Without Pedestals) Wall-hung Plan: Wall Radiator	Black-with Green Diagonal Lines Black-Filled in Solid with Green Black-Green Center Line or filled in solid with Green	
	On Ceiling: Wall Radiator	Black-Green Diagonal Lines	
	Circular Radiator	Black-Fill in solid with Green between two outer Circles	
	Vento Sections	Black-Green Diagonal Lines	
	Elevation or Corner: Pipe Coil	Black	
	Plan: Pipe Coil (Show Pipes if desired)	Black	As required

Discrepancies in Official Publications.

Some of the statements in a recent bulletin issued by the Bureau of Mines and entitled "Saving Fuel in Heating a House" are challenged by the *Gas Institute News*. For instance the bulletin states:

"As a fuel for residence heating, coke has the merit of cleanliness, but much of the heating apparatus in use to-day is ill adapted to burning it, and hence the obtaining of satisfactory results is rendered difficult, if not impossible."

Regarding this statement the *Gas Institute News* says:

"The redeeming feature of such statements, even from official sources, is the fact that they are so far from the truth that it would seem as if it was not necessary to contradict them. However, the institute can hardly afford to let such statements pass without giving conclusive evidence of their gross inaccuracy. The best evidence seems to be the facts in regard to the sales of coke for domestic purposes.

"It is the usual experience of gas companies making gas coke that they are able to sell all their product at a fair price without much effort. The local demand generally takes it all. A large percentage, probably over 90%, is used for cooking and heating, in appliances not especially designed for coke burning.

"The fundamental reason for this fuel being used in place of the ordinary hard coal is the fact that in a heating test of the coke compared with the ordinary hard coal sold it shows a greater heating value, due principally to a less percentage of ash.

"It is further interesting to note that in Bulletin 336, issued by the United States Geological Survey in 1898, a series of tables giving the efficiency of fuels, anthracite coal is given as 66, bituminous coal as 68, and coke 71; and in another test for standard fuels anthracite coal was placed at 49 and coke at 63.

"On page 27, of this same technical paper No. 97, there also appears this statement:

"'Coke cannot be burned in the same way as either anthracite or bituminous coal. The heater should be specially designed for burning it, or satisfactory results may not be obtained. Under a low draft *it ignites less rapidly than anthracite or bituminous coal,* and the heater should be especially designed for burning coke, or satisfactory results may not be obtained.'

"The phrase in italics stamps the production as having been written by someone with little or no experience whatever, for it is a well-known fact to all housekeepers that the relative kindling properties of various fuels are as follows: Charcoal, gas coke, bituminous coal, hard coal and hard coke.

"The large sales of coke that have been made during the last few years in our northern states by the gas companies, and the accomplishment of continued sales without the change of appliances wherein to use the coke, prove conclusively that coke can be burned in the same appliance as anthracite coal; that the heater need *not* be especially designed for burning it; that eminently satisfactory results can be obtained without changes, and that under a low draft it ignites *much more rapidly* than either anthracite or bituminous coal."

Current Heating and Ventilating Literature.

Under this heading is published each month an index of the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the article mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

DISTRICT HEATING—

District Heating System at Whitby, Ont. J. Lanning. Ills. 1,500 w. Can. Engr.—Nov. 18, 1915. Heating and ventilating system for the Hospital for the Insane. 20c.

HOT WATER HEATING—

Hot Water Heating Systems. George E. Reid. Diagrams. Lecture before N. A. S. E., Washington, D. C. 3,000 w. Natl. Engr.—Nov., 1915. Philosophy of circulation. 20c.

RESEARCHES—

Notes on Some Recent Researches. J. E. Petovel. Ills. 50 pp. Manchester Assn. of Engrs.—Oct. 30, 1915. Part I. Heat transmission. Part II. Heat flow and ventilation. Part III. Gas engine research. Part IV. Strength of structures. Price on application.

SCHOOLS—

Power Plant of a Model School. R. J. Mullin. Ills. 3,500 w. Natl. Engr.—Nov., 1915. High school at Tacoma, Wash. Interesting details. Oil fuel system. 20c.

VENTILATION—

Development in Mechanical Ventilation Hygienically, Above Ground, Under Ground and Under Deck. James Keith. Ills. From a paper read before the Inst. of Marine Engrs. 1,800 w. Col. Guard.—Nov. 5, 1915. Design of ventilating systems. 40c.

American Society of Mechanical Engineers.

Announcement is made that the spring meeting of the American Society of Mechanical Engineers will be held in New Orleans, April 11-14, 1916. This date is six weeks earlier than usual. Members in the east are arranging to go in two parties, one by boat and the other by train, stop-

ping at Mammoth Cave and other points en route.

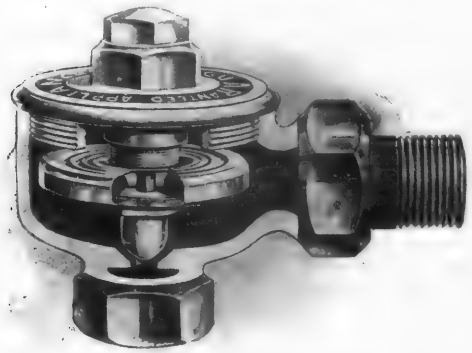
At a meeting of the society January 11, an address was given by Walter N. Polakov, superintendent of power of the New York, New Haven & Hartford Railroad, in which he demonstrated a simple method by which the owner of a power plant of any kind can, without the study of technical details, determine how closely the cost of his plant is to the possible minimum cost of such a plant.

NEW DEVICES

The Falcon Radiator Trap.

An interesting type of radiator trap, which, by the way, is the one used with the Trane vapor heating system, has been placed on the market by the Guaranteed Appliance Co., 14 East Jackson Boulevard, Chicago, Ill. It has been in actual service for several years and has been found to operate successfully on vacuum, vapor or steam heating systems, at pressures ranging from high vacuum up to 40 lbs.

This trap is made entirely of copper and the expanding member is a 2-in. diaphragm made of phosphor copper. This is filled with a sensitive liquid and in its normal



FALCON RADIATOR TRAP.

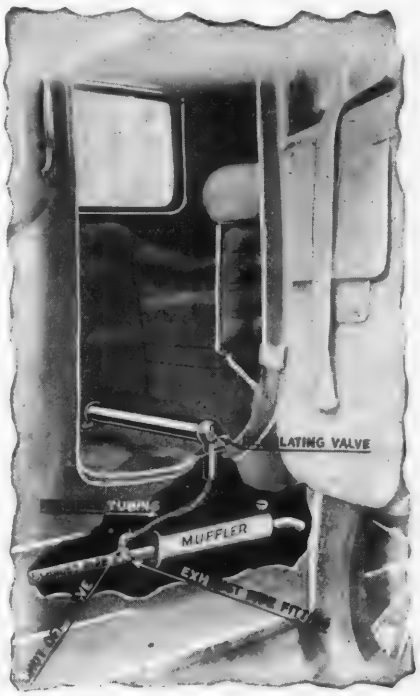
position has a maximum expansion of 3-16 in.

One of the features of the trap is a self-aligning stem within the diaphragm. This insures the correct seating of the plunger. Provision is also made for readjustment. The trap is self-cleaning as each discharge flushes the seat.

Normally the diaphragm is compressed. It holds the plunger from its seat and permits the free escape of air and water until steam reaches it and expands the plunger. The traps are made in ¼-in. and ½-in. sizes.

Utility Automobile Heater.

Another type of automobile heater has been brought out by the Hill Pump Valve Co., Chicago, Ill., and is illustrated herewith. It utilizes the exhaust gases from the motor to warm the interior of the car. The heater is really a radiator and footrest combined, and is said to keep the car



UTILITY AUTOMOBILE HEATER.

heated to a comfortable temperature even in the coldest weather.

The heater itself is connected to the exhaust pipe by a flexible tube that fastens to the exhaust line just ahead of the muffler. A special fitting is provided for this purpose to fit any size of pipe. A shut-off valve is furnished to be used when it is desired to turn the heat entirely off, while a special regulating valve is located at one end of the heater for regulating the heat to any desired temperature.

Two sizes are being produced. Both types are heavily nickeled. The heater can be permanently installed in half an hour by drilling two small holes in the tonneau floor and one in the exhaust pipe, and, once in place, it costs nothing to maintain.

Electric Automobile Heater.

Some of the problems connected with the handling of automobiles in cold weather have been solved by a simple and compact electric heater recently placed on the market by the Hughes Electric Heating Co., 211 West Schiller Street, Chicago, Ill. This heater is shaped like a common dry cell and is about the same size. It contains a heating element that takes but 100 watts on any 110-volt lighting circuit, to which it is attached by a 10-ft. cord and plug. The shell and end caps are suitably designed to protect the element, while the shell is perforated to allow circulation of the heated air from within. The outfit weighs less than 1 lb.

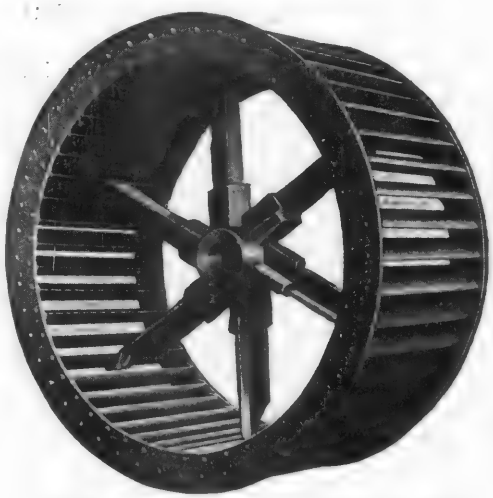
HUGHES' ELECTRIC AUTOMOBILE HEATER.

When in use the heater is placed within the hood of the car, the heat generated serving to keep the vitals of the car at a uniform, safe temperature which permits starting up without delay or exertion. The cost of the heating current necessary is 1 cent or less per hour where the maximum rate is 10 cents per kilowatt hour.

Clarage Kalamazoo Multiblade Fans.

A unique type of multiblade fan, designed to handle large volumes of air with a low peripheral velocity, has been placed on the market by the Clarage Fan Co., Kalamazoo, Mich. It is known as the Clarage Kalamazoo multiblade fan. The manufacturers state that these fans have been found to equal in mechanical and volumetric efficiency and to surpass in strength and adaptability any other fan on the market. They are equipped with babbitted bearings, entirely enclosed and protected by felt washers.

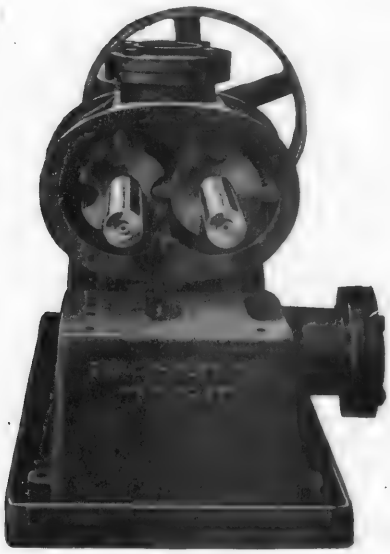
Among the points of interest mentioned for this fan are that the number of the fan equals the approximate diameter of the wheel in feet; that the extra large inlet area reduces friction and increases the volume of air handled; that the large outlet permits a low velocity of air travel without noise; that the shape of the blades forms a beam of great strength, considering the weight, and allows of high speed without bending, as well as permitting a center spider drive; that the center spider is an ideal arrangement, making the wheel suitable for both right and left hand housing, and allowing of the use of double inlet, single width fans, which are more efficient, while the wheel is easily kept in balance; that the wheels have 60 blades in all but the very small sizes, while the blades are riveted to heavy annular rings or rims. On large sizes a center rim and two spiders are used to give greater stiffness at high speeds. The housing details are similar in construction to those used on all Clarage steel plate fans.



NEW CLARAGE MULTIBLADE FAN.

Beach-Russ Return Line Vacuum Pumps.

An experience of twenty-four years in the manufacture of vacuum pumps is one of the points emphasized by the Beach-Russ Co., New York, in calling the attention of the trade to its line of return line vacuum pumps for vacuum heating systems. The accompanying illustration shows one of these pumps with the head-plate removed. It is said to be quite noiseless in operation, withdrawing the condensation and air from the radiators in a building, separating the air from the water and returning the condensation to the boiler under 10 lbs. pressure, or the condensation can be discharged into a receiving tank and then to the boiler. This pump can be applied to either new or old steam heating plants of any capacity, whether supplied from boiler or from a central heating station. The fact that the



BEACH-RUSS RETURN LINE VACUUM PUMP.

pumps have no intricate parts and have nothing to wear out is mentioned as practically disposing of the item of repairs.

The Beach-Russ Company also manufactures a full line of air line vacuum pumps, made of monel metal, which does not rust or corrode.

New Publications.

PETROLEUM AND ITS PRODUCTS, describing its properties, and accompanied by specifications and tables, is a recent publication (Bulletin No. 9) issued by the Kansas City Testing Laboratory, 1013 Grand Avenue, Kansas City, Mo. It sells at 25 cents a copy. The bulletin presents a summary of the production and uses of petroleum and contains useful information concerning the properties of petroleum products. One of the tables shows the cost of heating with petroleum compared with other fuels, based upon 1,000,000 B.T.U., as follows:

Petroleum.....@ $1.00 per bbl. = 0.18c.; with 80% efficiency = $0.23.
Cherokee slack coal @ $3.00 per ton = 0.13c.; with 66% efficiency = $0.20.
Natural gas @ 27c. per 1,000 cu. ft. = 0.27c.; with 80% efficiency = $0.33.
Coal gas.....@ 50c. per 1,000 cu. ft. = 0.79c.; with 80% efficiency = $1.00.
Electricity.....@ 1c. per K.W. hr. = 2.93c.; with 100% efficiency = $2.93.

COLORADO SCHOOL OF MINES QUARTERLY for October, 1915, contains, among other things, an article by Professor R. S. Hawley, professor of mechanical engineering, on "Systems of Heat Distribution," devoted to exhaust steam heating methods. The paper is part of a thesis on "A Treatise on Exhaust Steam Heating, with Consideration of Power Costs." The quarterly is published by the Colorado School of Mines, at Golden, Colo.

Trade Literature.

THE SPENCER CLEANER SYSTEM, featuring the Spencer turbine vacuum cleaner, is the subject of an impressive catalogue, published by the Spencer Turbine Cleaner Co., Hartford, Conn. In a foreword, attention is called to the beginnings of vacuum cleaning, the writer adding, "The misfortune of vacuum cleaning was that its possibilities were so great, its attractiveness so overwhelming, that a number of charlatans, as well as reputable manufacturers with plenty of money, but with no special knowledge or experience, rushed into the industry for the sake of its apparently great and easy profits." This, it is stated, has resulted in a large number of ambitious but unscientific devices, together with a vast amount of "atrocious" engineering. The catalogue then proceeds to discuss various methods of vacuum cleaning, such as the portable apparatus, the use of the piston type of machine, both of which are declared to be inadequate. It is then pointed out that the Spencer system does not depend alone on the use of a turbine cleaner, but also on the design and proportioning of the system itself. Numerous buildings are shown in which the Spencer system is installed, including the Woolworth Building, New York, and the Widener Memorial Library at Harvard University.

Probably the most interesting portion of the catalogue to engineers is that containing performance curves in a number of installations and the point is made that the final answer is not the vacuum maintained when first installed or for a few months thereafter but the vacuum maintained at the end of the hose after several years of continuous use. Size 8½ x 11 in. Pp. 32.

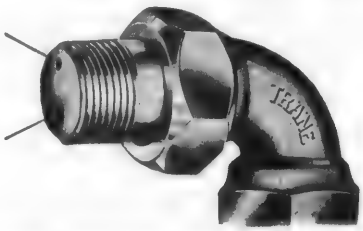
RELIABLE VACUUM HEATING NEWS, for January, 1916, the monthly periodical of the Bishop-Babcock-Becker Co., Cleveland, O., contains a practical article, illustrated by a diagrammatic sketch of a typical installation, on "How and Why the Reliable Return Line Vacuum Heating Equipment Provides Efficient Heating." One of the features of the *News* is its "Questions and Answers Department," relating not only to Reliable vacuum and vacuvapor heating equipment, but to vacuum heating in general. Size 7½ x 9 in. Pp. 8.

ALLIS-CHALMERS CENTRIFUGAL PUMPS AND CENTRIFUGAL PUMPING UNITS, describing all the types of centrifugal pumps made by the Allis-Chalmers Co., Milwaukee, Wis., are dealt with in an elaborate new catalogue (Bulletin

No. 1632) recently issued by the company. Size 8 x 10¾ in. Pp. 48.

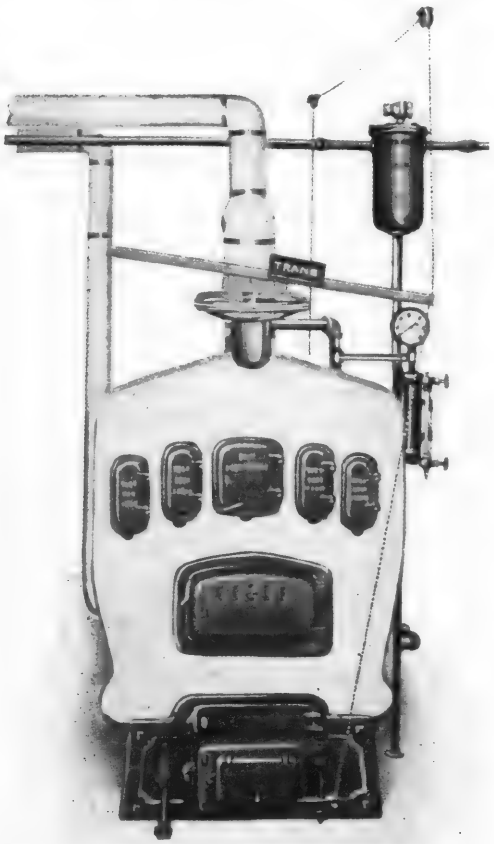
COYNE NATIONAL TRADES SCHOOLS, Chicago, is the ttile of a catalogue issued by this institution whose courses include those on electrical engineering, plumbing, etc. The Coyne Schools have been in operation 16 years. All instruction is given by practical work with the standard tools used in the trade. Practical construction work is carried on by the students. No text-books are used, and the school does not have classes. At the same time, instruction is individual. Size 8 x 10½ in. Pp. 80.

TRANE VAPOR HEATING SYSTEM is the title of a well designed catalogue issued by the Trane Co., La Crosse, Wis. This system consists of special radiator valves, return fittings and special boiler appliances, and operates at atmospheric pressure. There is no condenser in the basement, the idea being to have the radiators furnish all the condensing effect necessary. One of the principal appliances used with the system is a sensitive vapor regulator which controls the draft so that the pressure cannot rise beyond 3 or 4 oz. In addition to the patented graduated radiator valve used, the return fitting is of unique construction. The outlet consists of two holes for air and water. The opening for



RETURN FITTING USED WITH TRANE HEATING SYSTEM.

water is at the bottom while the upper smaller hole is for the escape of air. It is stated that one reason why Trane systems heat up quickly is because when vapor first enters the radiators both holes are free and there is no resistance to the passage of the air which is displaced by the entering vapor. There is also a receiver used with this system which makes it possible to return water to the boiler at all times, even under a pressure of several pounds. Size 4½ x 8 in. Pp. 48.



BOILER EQUIPPED WITH TRANE HEATING SPECIALTIES.

FINDING AND STOPPING WASTE IN MODERN BOILER ROOMS is the title of a 68-page booklet devoted to the use and design of Cochrane meters, issued by the Harrison Safety Boiler Works, 3189 North 17th St., Philadelphia, Pa. In addition to the descriptive matter covering various types of the apparatus itself, the introductory part of the booklet takes up in detail the value of feed water and condensate meters as aids in the management of power plants. Size 6 in. x 9 in. (standard).

CLINTON HIGH TEMPERATURE CEMENTS, which, it is stated, will resist heat better than iron, steel or fire brick, are products of the Clinton Metallic Paint Co., Clinton, N. Y., which are described in recent circulars. They include asbestos furnace cement, asbestos retort cement, asbestos putty cement and asbestos stove putty. The asbestos furnace cement is used for cementing joints and protecting iron and steel surfaces which are exposed to intense heat. This cement, it is stated, will also make absolutely tight and strong joints. It is said to be especially useful in mounting and repairing furnaces, heaters, etc.

New Type of Sheet Metal Radiator.

Something new in the way of a radiator is the Pressweld "radio" alloy sheet metal for direct and indirect steam and water heat-

ing which have been brought by the American Pressweld Radiator Corporation, Detroit, Mich. This radiator is made up of uniform sections, each section consisting of two plates of heavy gauge, radio alloy sheet metal, made especially for the purpose, stamped out by presses and then united by a special welding process which, it is stated, results in a perfect steam and watertight joint.

The sections are joined by a special right hand nipple top and bottom, which is featured as the most practical connection ever made to add sections or to reduce the number of units at any time.

Among the advantages mentioned for the Pressweld radiator is that it will heat quicker, cool quicker and radiate more heat from a given surface than a cast-iron radiator because of the thinness of the metal, and the smoothness of the interior surface, permitting more rapid circulation, also wide air spaces for uniform heat distribution.

Attention is also called to the light weight of the Pressweld, which is one-fourth the weight of a cast-iron radiator of equal capacity.

The company has issued a catalogue containing full details of this line, including tapping lists, measurements and capacities.

How Can Engineers Best Utilize the Technical Journals?

That we cannot keep abreast of the times without reading the engineering journals is obvious. That if we carefully read all the engineering journals in our chosen specialty we would have no time left to earn a living is easily capable of demonstration. What then is the proper attitude to adopt toward this ever increasing flood of information that pours in upon us so relentlessly, week after week, month after month, and year after year?

What shall the reader do with his special selection, from his technical journal, when once he thinks he has separated them from the flood of raw material?

Several courses are open to him:

1. He may rely on his memory and the published index to his bound volumes.

It is safe to say, however, that few engineers really make much practical use of this method. The intervening index and the bother of a search following, prove to be discouraging to that degree that a proposed reference search is abandoned in about one-half the suggested attempts. The ideal filing system is the one in which, with the least amount of effort, one can put his hand immediately and accurately on the thing itself, be it a book, a pamphlet, or a data sheet.

2. He may keep a special card index of important data, and reference to valuable articles. This at once involves labor and attention, which few busy men can give, and which, if done by assistants or librarians, largely loses its personal value to the one who needs it. The same objection as to the discouraging effect of intervening indexes holds good here, too, and it is further safe to say that of all the contrivances for indexing, the most difficult to readily handle and rapidly examine is the card Index system.

3. He may abstract important data in a limited way on loose leaf transparent paper, standard letter size, and he may remove or detach articles of special value from out his journals, to be filed in regular office file system, like correspondence.

The writer has tried all of the above methods at considerable cost in time and patience, and has, for many years, settled upon the the third method above outlined. With all its admitted limitations it seems to be the best for an office which is expected to find out information on a great variety of subjects in a limited time, and with the least amount of effort.

Some description of its practical workings may be of interest here.

All the technical papers of the office pass on to the desk of the head of the office and are at least looked over (not read) by him. Articles important to his particular specialty are checked with pencil, and articles of especial interest are looked over with care and double checked. Once in a long while data important enough to go to the data file is noted. This is either especially abstracted by the stenographer, or, if a diagram or cost data, perhaps traced in the drafting room; all on transparent paper for copying purposes. Special data of this kind on 8½ x 11 in. sheets is filed in the office data file (a separate but common standard correspondence file). From the data file loose leaf working notebooks are made up from blue prints for office or travel purposes. They are altered, refilled, amended, and sorted back from time to time as needed to keep them of usable volume and usefully up to date.—*John W. Alvord before the Federation of Trade Press Associations.*

Talking Points for Better Heating Installations.

The question of heating our homes, though one of the most important items which enter into the general scheme of successful house design, is the one which is most frequently neglected. We are particular to have the architectural details worked out to conform to our

ideas—and we generally have ideas about almost everything except the heating of the home, but when it comes to the heating, all we consider is the first cost. We install the cheapest system we think we can get along with, and the lowest bidder gets the job. Now this is all wrong. The external appearance of the house, the arrangement or rooms, halls and closets, the interior decorations, the selection of lighting fixtures, etc., are all important elements in the designing of a house, but do any or all of these affect the health or happiness of the occupants nearly so directly as the system of heating which is to be installed? Couldn't we much more easily put up with changes in some of those items which would prevent them from conforming exactly to our ideas, than we could put up with a poor or inadequate system of heating? For more than half of the year we need artificial heat in our homes, and those of you who have lived in poorly heated houses know that nothing is so great a hardship to a family as the lack of proper heating arrangements.

We also, in designing our homes, consider very seriously the question of maintenance in almost everything except the heating. We endeavor to make the house and its furnishings as durable as possible in order to reduce the cost of maintenance; but the heating system is seldom included in this scheme of after economy. More often the lowest first cost of installation is what the owner considers. In such cases he subsequently pays for fuel poorly utilized—many times the saving in first cost of installation, besides not obtaining the desired heating results. It would be better and more profitable to install an efficient, durable, and above all, an adequated heating system, which would save fuel and annoyance every day that the house has to be heated.—*Roy E. Lynd, before the Borough Club of Tenafly, N. J.*

Handy Hot Water Tank Regulator.

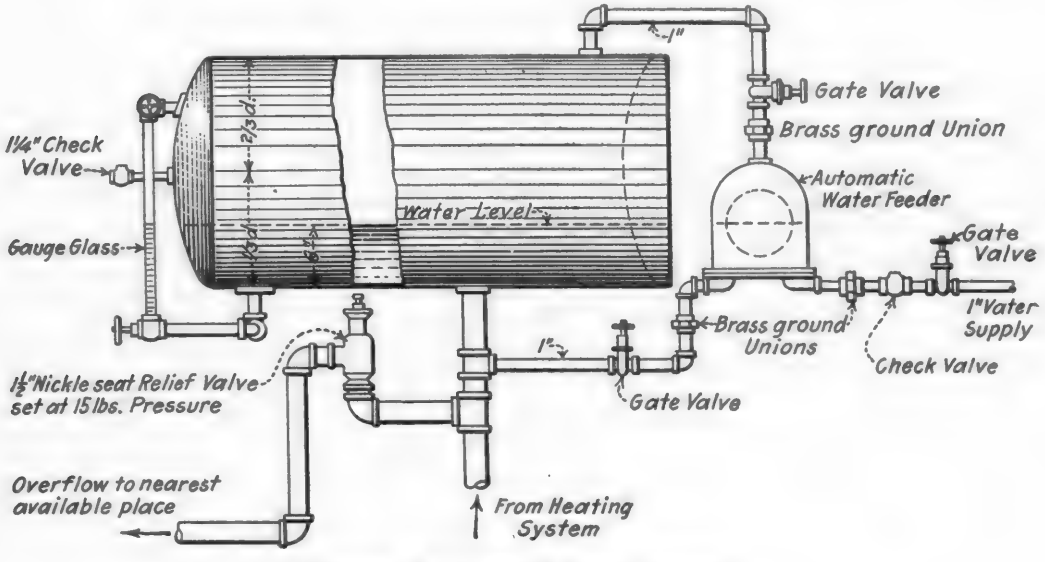
A handy hot water tank regulator, by which the amount of coil surface in iron pipe and in brass pipe, as well as the pounds of condensation per hour, may be quickly figured, is being sent out by the Powers Regulator Co., Chicago, Ill., with its compliments and New Year's wishes. The calculator is of celluloid with a superimposed separate disc. By moving the upper disc around in the desired direction until the various figures involved register, the result is read directly from the calculator.

Expansion Tank Data for Hot Water Heating Systems.

The following tables, useful in connection with computing the sizes of expansion tanks required in hot water heating systems, give the number U. S. gallons of water in round tanks of variable diameters and depths, and in one foot of wrought iron pipe for various sizes.

One square foot of cast-iron direct or indirect radiation contains 0.1875 U. S. gals. The usual temperature rise allowed in hot water heating systems is from 60° to 220° F., or an increase of 3.8% of all the water in the system. In installations of small capacity, an allowance of 5% is necessary.

In computing the required capacity of a tank, due allowance should also be made



TYPICAL EXPANSION TANK DETAIL.

EXPANSION TANK DATA.

U. S. Gallons of Water Per Foot of Wrought Iron Pipe.

Size.	1	1¼	1½	2	2½	3	3½	4	4½	5	6	7	8	10	12	14	16
U. S. Gals.	.045	.078	.106	.174	.249	.384	.514	.662	.83	1.04	1.5	2.02	2.6	4.1	5.88	8.3	11.0

U. S. Gallons Contained in Round Tanks.

Depth, ft.	Diameter in Feet. 1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
2	12	26	47	73	106	144	188	238	294	355	423
2.5	15	33	59	92	132	180	235	297	367	444	529
3	18	40	71	110	159	216	282	357	441	533	635
3.5	21	46	82	129	185	252	329	416	514	622	740
4	24	53	94	147	212	288	376	476	588	711	846
4.5	26	60	106	165	238	324	424	535	661	800	952
5	29	66	117	184	265	360	480	595	734	889	1,060
6.5	35	79	141	221	318	432	564	714	870	1,066	1,270
7	41	93	165	258	371	504	658	833	1,015	1,244	1,480
8	47	106	188	294	424	572	752	952	1,160	1,411	1,690
9	53	119	212	235	477	644	846	1,070	1,305	1,600	1,900
10	59	132	235	372	530	716	940	1,190	1,450	1,777	2,110

for the cold water level to show in the guage glass at a height 6 in. above the bottom of the tank, as shown in the expansion tank detail.

In the detail a tank is shown connected to an automatic water feeder which maintains a minimum water line. The supply is through a gate, then a check valve. An equalizing pipe and pipe inlet to tank, each with a gate valve, is provided, as shown. A 1½ in. nickel seat relief valve, set at 15 lbs. pressure, provides the necessary relief for high pressures. The overflow is run to the nearest available place and the water from the heating system enters as shown. The guage glass is equipped with shut-off valves.

Correct and Incorrect Methods of Connecting Branches to Main Ducts.

The proper manner in which to connect the branches of a ventilating system to the main or trunk duct for the conditions shown is illustrated by Figs. 1 and 2, in which the dotted lines indicate the more usual, but incorrect, way.

A connection made as shown in dotted lines in Fig. 1 would require the use of a volume damper in order to throttle the air supply, as this connection is in direct line

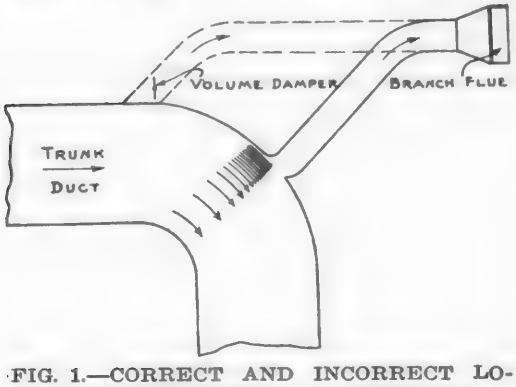


FIG. 1.—CORRECT AND INCORRECT LOCATION OF BRANCH CONNECTION.

with the main travel of the air in the trunk duct. While this could be readily accomplished, it would be objectionable, due to the noise caused by a high velocity, and would be undesirable particularly if installed in a schoolhouse, where quietness of operation is required. The full lines indicate the more advisable method, though

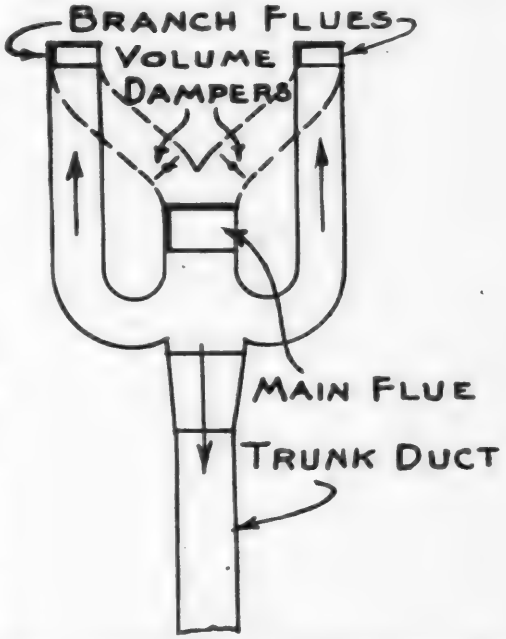


FIG. 2.—SUPPLYING AIR FROM MAIN TO BRANCH FLUES.

this would serve to decrease the amount of air supplied to the connection. However, the apparent disadvantage may be overcome by the partial closing of the dampers at all connections beyond. Furthermore, the tendency for the main travel of the air is to follow the outer circle of the main duct, as shown by the arrows.

A somewhat similar case is shown in Fig. 2. In this instance, the supply of air

to the two flues would be too great, due to the slight resistance set up by their short connections to the main flue, especially when compared to the longer run to the flues further on. Otherwise the remarks applying to Fig. 1 are of equal force.

Gold Medal for Cochrane Metering Heater.

An award of the gold medal was given the Harrison Safety Boiler Works, Philadelphia, for its exhibit of the combined open-feed water heaters and hot water meters, known as the Cochrane metering heater, exhibited at the Panama-Pacific International Exposition in San Francisco. This apparatus is designed to heat boiler feed water by means of exhaust steam from engines, pumps, etc., and simultaneously to meter the water and record the rate of flow, and to integrate the total flow in any elapsed period.

Year Book of New York Chapter of Heating Engineers.

The New York Chapter's Year Book for 1915-1916 has been published in vest-pocket size. It contains the officers, committees, constitution and by-laws, as well as the papers read at different times before the chapter since its organization in 1911. The list of members given is corrected up to January 1, 1916. The chapter has 75 members in all classes.

Herbert Coward, for three years in charge of the Spiro turbine department of the Buffalo Forge Co., has been appointed steam engineer of the Carrier Engineering Corporation, of New York.

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TRADE AND MISCELLANEOUS NOTES

Coming Events.

April 11-14, 1916.—Spring meeting of the American Society of Mechanical Engineers, New Orleans, La.

Deaths.

Charles C. Scaife, president of Wm. B. Scaife & Sons Co., Pittsburgh, Pa., one of the pioneer firms in the heating and plumbing trade, died December 31, 1915, at his home in that city. He was 71 years old. The company's principal product, galvanized range boilers, were developed to a point where their use was country-wide. Mr. Scaife's father designed and patented the original dome-head range boiler, and to Charles C. Scaife belonged the credit for the invention of the first successful rivetless hot water boiler. The company with which he had been connected for over fifty years was founded by his grandfather, Jeffrey Scaife, in 1802. It is thought that his death was hastened by the loss of his son, Charles C. Scaife, Jr., secretary of the company, who died last November.

L. H. Prentice, Jr., son of L. H. Prentice, vice-president of the L. H. Prentice Co., Chicago, heating and ventilating and power plant contractors, was drowned January 3, 1916, in the Mississippi River, near Bolivar Landing. He was on a duck-shooting cruise in his 60-ft. naphtha launch. Efforts were made to recover the body, but without avail. Mr. Prentice was 27 years old.

John A. Hill, president of the Hill Publishing Co., New York, publishers of technical publications, died suddenly January 24, while riding in his automobile to his office. He was 57 years old. *Power* and *Engineering News* are two of the technical journals published by this company. Mr. Hill had won a high place in the field of technical publication, having contributed largely to

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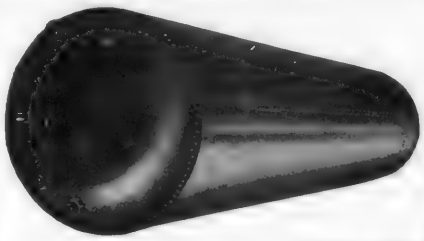

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the adoption of better standards of ethics in the conduct of trade papers, as well as achieving notable business successes with his various periodicals.

Miscellaneous Notes.

Minneapolis, Minn.—The Womroth system of ventilation, invented by George F. Womroth, business agent for the Minneapolis Board of Education, is being tested in a grade school in that city, with a view of having the system installed in all of the schools in Minneapolis. The system provides for the individual ventilation of each room, the air being taken from the top of the building, passed over a heating coil and blown into the room by means of a fan. It differs from the system now in use in that at regular intervals the fan is reversed and the air blown out through the same duct. This is expected to result in a "breathing" effect. It is claimed for this system that it will keep all of the air in the room in circulation, as well as providing effective ventilation.

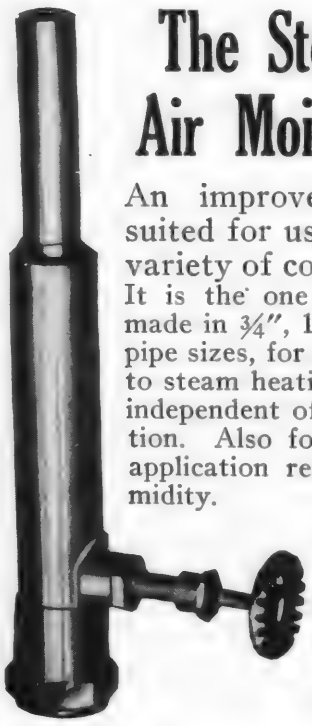
Chicago, Ill.—President F. W. Lamb of the Chicago Master Steam Fitters' Association, is recovering from a severe attack of pneumonia.

Central Supply Association will hold its mid-winter meeting in Chicago February 23, 1916, with headquarters at the Auditorium Hotel.

Chicago, Ill.—"Ventilate—don't hibernate" is the advice of Chicago's health department, the warning having followed the reports of deaths for the last week in December which ran 400 over the average.

Chicago, Ill.—The case against Oscar H. Heinemann, silk manufacturer, who was charged with failure to equip his factory with proper ventilating apparatus was nonsuited when his attorneys made the plea that the notice served on the factory had not been sufficient warning. A new notice has been served and a new suit filed. Eleven additional charges were continued. The case had attracted considerable attention and several women's organizations sent representatives to appear at the trial.

Rock Island, Ill.—A total of $50,463.50 was spent in Rock Island during 1915 for heating plants. Of the various types of heating plants, hot air furnaces lead in number, with hot water second, vacuum third, and steam forth. There were 252 individual plants placed in homes or business buildings, October showing the great-



The Steamo Air Moistener

An improved type suited for use under a variety of conditions. It is the one pipe type, made in ¾", 1" and 1¼" pipe sizes, for attachment to steam heating systems independent of the radiation. Also for industrial application requiring humidity.

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28 N. Market Street, Chicago, Ill.

RELIABLE
Vacuum and Vacu-Vapor Heating Equipment is Really RELIABLE

The BISHOP-BABCOCK-BECKER CO.
Manufacturers, CLEVELAND, O.

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est activity with 40 plants, while March was lowest, with 8 permits.

Chicago, Ill.—Dr. John Dill Robertson, commissioner of health for Chicago, states that since assuming his present duties he has received from ten to fifteen letters a week from parents and teachers, complaining of the ventilation in the public schools. It has been found that many of the complaints apply to schools equipped with modern types of mechanical ventilation. The letters have been sent to the chief engineer of the department of education and will be the subject of a special investigation.

Salt Lake City, Utah.—Through its failure to submit plans for its new $6,000 heating plant to the State Board of Education for approval before its construction, another $1,000 will be added to the expense of the Nephi School Board, according to R. C. Watkins, state building commissioner. He stated that no provision had been made in the plans for ventilation.

National Association of Master Plumbers has published the proceedings, in bound form, of its thirty-third annual convention, held last summer in Chicago. The volume contains 360 pages and is issued from the office of the president, James S. Cassedy, 689 Massachusetts Avenue, Cambridge, Mass.

Cleveland Master Steam and Hot Water Fitters held their annual meeting and banquet at the Hofbrau Restaurant, Cleveland, December 20. Walter Klie was the toastmaster. Addresses were made by the retiring president, D. A. Stuart, Vice-President W. L. Crowell, Secretary W. B. Van Sickle, Edward Hobday, attorney for the association, and others. The following officers were elected: President, M. L. Crowell; vice-president, William Chafer; secretary, W. B. Van Sickle; treasurer, A. E. Welker; directors: Walter Klie, Albin Seidel, D. A. Stuart, Edward Mauser and William Warren.

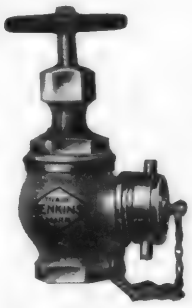
Central Station Heating Notes.

Detroit, Mich.—A series of explosions in manholes of the Edison Illuminating Company in Detroit, early in January, deprived many builidngs of heat, light and power. It is thought that needle ice in a valve in the intake was the original cause of the trouble. The explosions were due to an overloaded electric cable which melted and took fire, igniting gas in the tunnels.

New York Steam Company, New York, has placed a contract with the Milliken Bros., Inc., for 1,500 tons of fabricated steel for the construction of a boiler house at Burling Slip, East River.

Hibbing, Minn.—Complaints that the heating rates in Hibbing have increased 100% have led the water and light commission of the city council to consider a change in the system of charging. Under the present system, consumers pay 60 cents for each 1,000 lbs. of condensation. This is considered to be the equivalent of 42 cents per square foot per season.

Ritzville Heating Co., which is establishing a central heating plant at that place, has sent its articles of incorporation for



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filing. The company is organized with a capital stock of $200,000, and has the following officers: President, H. B. Spear; secretary, G. E. Lovell; directors: David Hoefel, Henry Rosenoff, Jr., J. P. Koch and J. B. McCoy. Ultimately it is planned to have a system large enough to heat all of the business houses on Main Street.

Washington, D. C.—Revised bids opened for the construction of the central heating and power plant in Washington included one of $1,397,484 from the W. G. Cornell Co., of New York and Washington. Another bidder was George T. Kelly, of Yonkers, N. Y., whose revised bid was $1,436,000. The available appropriation for the work is $1,494,104, so that the Cornell company bid gives a margin of $96,620 under the appropriation, while that of George Kelly provides a $58,104 margin.

Des Moines, Ia.—It is announced that the proposed heating franchise in favor of the Des Moines Electric Company will probably be submitted to the voters at the city election in April. It is planned to install the central heating plant in the fall of 1916.

Manufacturers' Notes.

Sarco Company, Inc., New York, has been formed to take over the Sarco Engineering Co. and the Roller-Smith Co., of New York City and Bethlehem, Pa. The

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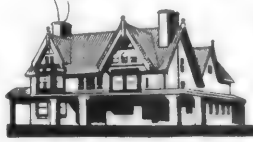

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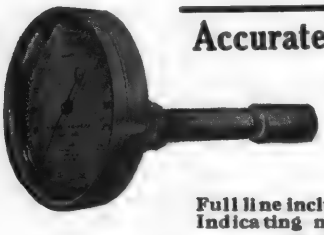

Accurate Service Is Assured When You Use

Standard Indicating and Recording Thermometers

Guaranteed Correct

Full line includes seven types of recording thermometers and a special line for mechanical uses Indicating mechanical thermometers are furnished with extensions from 2 to 30 in. in length

All thermometers are double and not breakable.

STANDARD THERMOMETER COMPANY Clinton and Shirley Streets BOSTON, MASS

BOUND VOLUMES OF

THE HEATING AND VENTILATING MAGAZINE

Vol. XII for 1915 Now Ready

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Price, postpaid, $2.50

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The Heating and Ventilating Magazine, 1123 Broadway, New York

Better Valves

Detroit Packless Radiator Valves were designed to meet the demand for better valves.

They have proved to be better in every way—they are absolutely tight and will stay tight—they do not leak around the stem nor need repacking.

The installation of Detroit Packless Valves means economy and permanent satisfaction for the building owner.

Detroit Packless Radiator Valves

are being specified in prominent buildings throughout the country because they meet that all-important requirement of maximum utility combined with beauty of line and finish.

The first cost is the whole cost—there is no occasion for having a man spend most of his time keeping them in condition, and there is no danger of their becoming unsightly from rusty, dirty water.

Their lines are substantial, symmetrical and pleasing.

The metal surfaces have a smooth satin finish that will not deteriorate—the handles are mahogany finish, large and nicely proportioned. In fact, Detroit Packless Valves are finished in a manner to harmonize with the most beautiful surroundings.

And the line is complete—angle—corner—globe—gate—in all sizes for every kind of installation on steam and hot water systems.

Illustrated Booklet V-46 gladly sent on request.

"A Radiator Valve That Can't Leak"

Equipped with Genuine Detroit Packless Radiator Valves.

DETROIT LUBRICATOR COMPANY

DETROIT, U. S. A

Canadian Detroit Lubricator Company, Ltd. WALKERVILLE, ONTARIO.

Makers of the Stewart Carburetor

EQUITABLE BUILDING, NEW YORK
Architect, Ernest R. Graham
Heating Contractors, Thompson-Starrett Co.

change is made as a result of the increase in the sales of steam traps Sarco and temperature regulators Sarco which, it is stated, have broken all records during 1915. The Sarco Co., Inc., which will handle all sales, will have the advantage of greatly increased selling and manufacturing facilities. The address of the company will be the South Ferry Building, New York.

Terry Steam Turbine Co., Hartford, Conn., announces the appointment ot Maynard D. Church as chief engineer of the company.

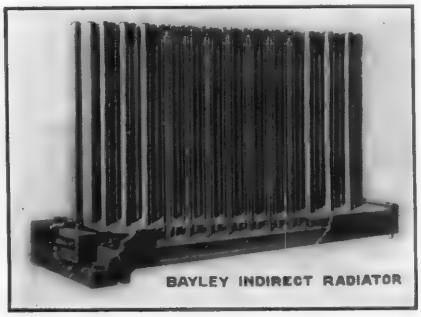
Walworth Mfg. Co., Boston, Mass., announces the appointment of Frank A. Bucknam as manager of its New York office. Mr. Bucknam was for over thirty years treasurer and general manager of the Nason Mfg. Co., New York. The Walworth Company has bought the business of Joseph E. Gallagher, New York, and has combined the business of its export department and power piping at the New York branch, which is now located at 19 Cliff Street. Mr. Bucknam will be assisted by Shirley R. Mitchell and a force of salesmen who will cover the metropolitan district.

P. D. Beckwith Estate, Inc., Dowagiac, Mich., has appointed Arthur A. Kiewitz as heating engineer in its Moistair Heater department. Mr. Kiewitz will handle the designing and selling of the Round Oak Moistair heaters in New York, New Jersey and the New England States, with headquarters in Long Island City, N. Y. In taking up his new duties Mr. Kiewitz leaves a position with the New York City Department of Education with which he has been connected for nearly fifteen years as engineer and designer of heating and ventilating apparatus. He was also for nine years an instructor in the evening schools. Mr. Kiewitz is a member of the American Society of Heating and Ventilating Engineers.

Bishop-Babcock-Becker Co., Cleveland, O., manufacturers of the Reliable vacuum heating specialties, announces the removal of its New York branch to larger and better quarters at 376-380 Lafayette Street. It is also announced that William E. Taylor has been appointed sales agent for Greater New York and northern New York State for the company's vacuum heating department, with headquarters at 145 East 34th Street.

Magee Furnace Co., Boston, Mass., has completed the removal of its plant from Chelsea to Taunton, although the Chelsea

Bayley new type of Indirect Radiator for heating, ventilating and drying purposes.


BAYLEY INDIRECT RADIATOR

The construction of this radiator is unique in that there are no elbows, return bends or nipples used.

Its efficiency is high, as the drainage is perfect, and as it frees itself readily from air, every foot is prime heating surface.

Its tubes are individual and thus free to expand and contract independently of any other pipe.

It is adaptable to almost any space, as it can be placed with pipes in a vertical or horizontal position or any modification of these positions. It requires no double decking (with double steam and drip connections and structural supports) to obtain necessary free area.

BAYLEY MFG. CO. MILWAUKEE WISCONSIN

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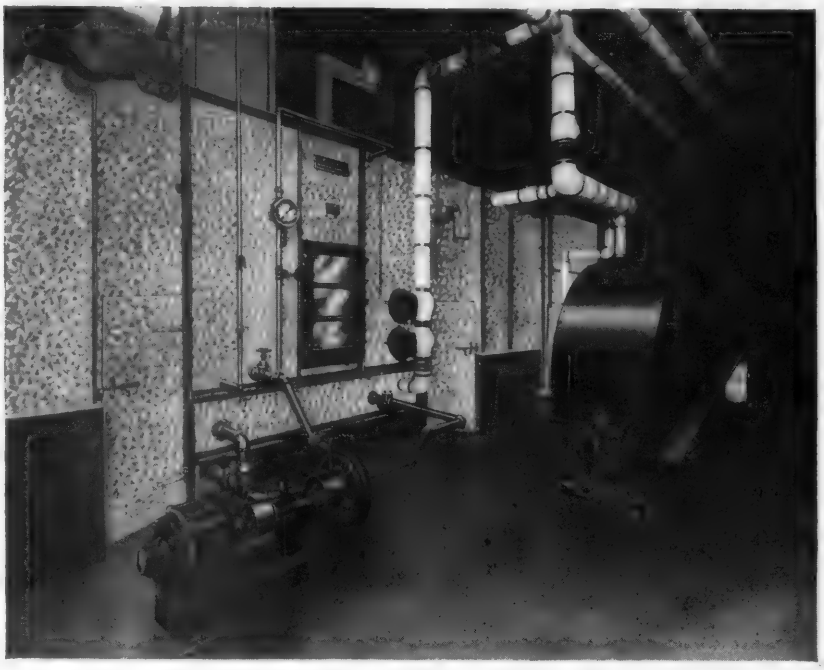

Air Washer in new Central Dormitory at Wellesley College, Wellesley, Mass.
Architects, Coolidge & Carlson, Boston, Mass.

Another Installation of

Sturtevant Air Washers
(REG. U.S. PAT. OFF.)

The Heating and Ventilating equipment at the new Central Dormitory was entirely supplied by this company. It includes a 4x6 Sturtevant Air Washer and humidifier, and a Sturtevant Steel Plate Fan driven by a Sturtevant Vertical Steam Engine.

The engine exhaust steam is used in the heater. The system has automatic temperature control.

Other recent installations of Sturtevant Air Washers include:

Miami Hotel, Dayton, Ohio
Bank of Italy, Los Angeles, Cal.
Frankfort High School, Phila.
Cleveland City Hall
East Ohio Gas Company Building, Cleveland
Rochester No. 17 School

Our Air Washer Department will co-operate with architects and engineers in the preparation of plans and specifications. If you have a problem in air conditioning, write us.

B. F. STURTEVANT COMPANY
HYDE PARK, BOSTON, MASSACHUSETTS
AND ALL PRINCIPAL CITIES OF THE WORLD

plant will not be entirely given up for the present. The company's Boston offices and showrooms will be continued at 38 Union Street.

Scientific Heater Co., Cleveland, O., manufacturer of gas heated boilers, etc., has appointed T. A. Quay as sales manager of its boiler department. Mr. Quay was formerly city inspector of heating and ventilating in Cleveland. The company has provided for an increase in its output of 50% through the acquisition of additional floor space in its power plant.

Homestead Valve Mfg. Co., Homestead, Pa., will act hereafter as eastern representative of the Taylor Steam Specialty Co., Battle Creek, Mich.

Lytton Mfg. Co., Franklin, Va., manufacturer of heating specialties, has opened a branch office in Chicago, at 1606 Tribune Building. The office will be in charge of C. H. Jewwell, the company's manager of sales.

Shirley Radiator & Foundry Co., Indianapolis, Ind., through its trustee, Russell T. MacFall, will have its plant sold by order of the court. The plant is located at Beech Grove, Ind.

Williamson Heater Co., Cincinnati, O., held the sixty-fifth annual banquet of its city and field salesmen in Cincinnati recently. E. O. De Camp was toastmaster. Addresses were made by A. W. Williamson, W. C. Williamson, John N. Richardson, W. T. Jameson, J. I. Edwards, Daniel Lape and Ray Kirkpatrick.

Parker Mfg. Co., Florence, Ala., whose organization was recently announced with a capital stock of $17,500, has located at Chattanooga, Tenn., where it will engage in the manufacture of the Parker system of heating and ventilation. This system is the invention of E. J. Parker, who will be the company's superintendent. It consists of a stove surrounded by an asbestos-lined jacket. The air is heated by convection and passes up through a series of perforations at the top of the jacket. The air so heated is taken in directly from outdoors. The system is sold under a guarantee that it will heat a given space in a given time to a given temperature with less than half the fuel required by other systems of heating. The officers of the company are: W. N. Graham, Florence, a merchant of that place; vice-president, S. W. Frierson, Florence, an attorney; secretary and sales manager, N. P. Morrison, formerly mayor of Florence; treasurer, C. E. Jordan, Florence, attorney for the Southern Railroad.

DIRECT CONNECTED BLOWER WITH HEATING COILS—NEW YORK EDISON BLDG.
ARCHITECTS, GRAHAM, BURNHAM & CO.

ILG

UNIVERSAL BLOWERS WILL PLEASE YOU

They are easy to install
They take up little room
They run without vibration

SALES OFFICES IN
CHICAGO NEW YORK
PHILADELPHIA CLEVELAND
PITTSBURGH ST. LOUIS DETROIT

Ilg Electric Ventilating Co.
158 WHITING ST., CHICAGO

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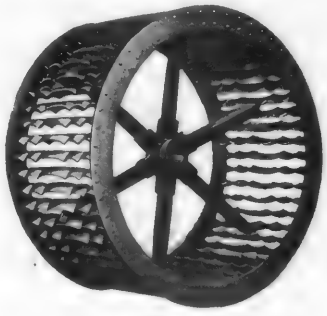
Architects, J. H. Felt & Co., Kansas City, Mo.

CHERRYVALE HIGH SCHOOL, CHERRYVALE, KANSAS

Sturtevant (REG. U. S. PAT. OFF.) Apparatus in Cherryvale

Above photograph shows the new Cherryvale High School which is ventilated by Sturtevant Apparatus.

The chief reason for the almost universal use of Sturtevant apparatus is the splendid service given by the company. The goods are right in every particular and the co-operation and advice of our Engineering Department goes with them. Our part in the transaction does not cease when we have merely sold apparatus, but we maintain a permanent interest in it, so that every single unit may work with absolute satisfaction to the customer.



Multivane Fan Wheel

Fifty years of following this policy has made us the largest manufacturers in the world of fans and allied products.

B. F. STURTEVANT COMPANY,

HYDE PARK, - - BOSTON, MASS.

And All Principal Cities of the World.

Bristol Co., Waterbury Conn., manufacturers of the Bristol line of recording instruments, has established a new branch office at San Francisco, Cal., in the Rialto Building. B. J. Klein, one of the company's sales engineers, has been appointed Pacific district manager and will have his headquarters at the San Francisco branch office. Mr. Klein is a mechanical engineer and instrument expert, having had a long experience with The Bristol Co., including a period of more than six years as Chicago district manager. He has been located in San Francisco during the past year as manager of the Bristol Company's exhibit at the Panama-Pacific Exposition. It is stated that this exhibit has greatly increased the demand for the company's products in the Pacific Coast territory.

New Firms and Business Changes.

Indiana Steam Heating and Plumbing Co., Inc., Indianapolis, Ind., has dissolved.

Philp & Paul, New York, contractors for steam and hot water apparatus, have removed to new and larger quarters at 174 East 119th Street.

Illinois Plumbing & Heating Co., Champaign, Ill., is a new partnership formed by A. C. Flanagan and Frank Shannon, both of whom were for many years in the employ of the Reliable Plumbing & Heating Co. The new firm has taken quarters at 128 South Walnut Street.

Joliet, Ill.—Louis A. Williamson, until recently plumbing inspector for Joliet, has tendered his resignation to enter the heating, plumbing and sheet metal business. He has purchased the sheet metal department of the Henson Hardware Company and will have offices at 107 West Jefferson Street.

Van Emery & Millard, Bronson, Mich., is the title of a new firm that will engage in the heating and plumbing contracting business. Mr. Van Emery is a mechanical engineer, while Mr. Millard has had some 35 years' experience in the heating and plumbing business. The firm has located in the Bronson Journal Building.

Werner Nygren, New York, formerly a member of the engineering firm of Nygren, Tenney & Ohmes, New York, announces that he has commenced a private practice of his own as consulting engineer for steam power, heating and ventilating installations, having secured his partners' consent to withdraw from the firm of Nygren, Tenney

Public Building Ventilation

requires the moving of large volumes of air without the noise of machinery.

Westinghouse Motors

have excellent performance qualities, being quiet and free from vibration and are, therefore, extensively used in the ventilation of—

Club Houses
Schools
Libraries
Theatres
Auditoriums
Hotels
Hospitals
Office Buildings

There is a Westinghouse Motor for every type of ventilation, for every size of building, for blowing or exhausting.

We have made many successful installations. Let us apply our experience to your next job.

Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.
Sales offices in all large American cities.

"Sirocco"

Good Materials—Good Design—Good Construction and Good Results

A combination which makes for permanent satisfaction.

Such prominent Engineering accomplishments as the Hudson Tubes—Pennsylvania Railroad Tunnel—Brooklyn Bridge Station—New York Terminal Station—Equitable Building—and many others in which our apparatus is installed is indicative of the confidence placed in our goods by the Engineering profession.

"Sirocco" Fans have These Good Qualities

The Ford Motor Co.—the Packard Motor Co.—Toledo Factories Building of Toledo, Ohio—the Baker-Vawter Co., of Benton Harbor were convinced that "Sirocco" had the merits claimed for it and installed it in their industrial and office buildings

The user displays confidence in "Sirocco" by installing and the Engineer displays confidence in "Sirocco" by advocating it—that's what has made "Sirocco" such a success.

An Engineer's binder of bulletins on "Sirocco" and "ABC" Products will be mailed at your request—they're standard size—Ask for Engineer's series No. 2509.

AMERICAN BLOWER COMPANY

DETROIT, MICHIGAN U S.A.

Canadian Sirocco Co., Limited, Windsor, Ont., Manufacturers for Canada.

The illustration shows a "Sirocco" Induced Draft Installation at the plant of the Farnum Cheshire Co., Farnum, Mass. Two No. 6 American "Sirocco" Fans.

& Ohmes. Mr. Nygren's offices will be located in the Architects' Building, 101 Park Avenue. He states that the policy which contributed so largely to the success of the firm from which he now retires, after being connected therewith since its inception, seven years ago, a policy inherited from the firm's predecessor, the late Alfred R. Wolff, whose assistant he was for fourteen years, will also be the policy of this new enterprise.

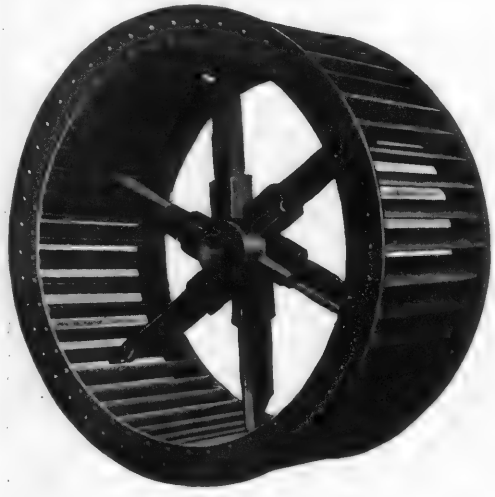
Tenney & Ohmes, New York, is the new title of the firm of Nygren, Tenney & Ohmes, consulting engineers for heating and ventilating and power plants, Mr. Nygren having retired from the firm to engage in an independent business as consulting engineer.

Business Troubles.

New York.—Bankruptcy schedules of Blake & Williams, heating and ventilating contractors, a corporation which failed recently, show liabilities of $255,663, of which $89,530 is secured and $1,339 is for wages. Nominal assets are $248,921, consisting of real estate, $107,298; stock, $11,265; machinery, $7,828; accounts, $107,062; cash in bank, $12,002; office furniture, $1,258; notes, $758; horses and trucks, $600; shares of stock, $850. Among the creditors are the American Radiator Co., $6,253; the E. F. Keating Co., $6,020; Francis A. Williams, $22,572, and Emma L. Wiliams, $14,500, both for money loaned.

New Incorporations.

Bailey Meter Co., 141 Milk Street, Boston, Mass., incorporated to manufacture and sell a complete line of recording meters and instruments for power plant and similar uses. These meters have been developed during the past six years in the mechanical engineering department of the Fuel Testing Co., of Boston. E. G. Bailey will devote his entire time to the new company, but the Fuel Testing Company will continue its regular line of work under the personal direction of W. B. Calkins, who has been a partner with Mr. Bailey since the organization of the company in 1909. The Bailey meters are adapted to accurately measure steam, water, air and gases, under all conditions of pressure, temperature and capacity. It is stated that the entire line of meters and instruments is fundamentally new. The Bailey Meter Company announces that it is prepared to take up all problems relating to the flow of fluids.



CLARAGE
KALAMAZOO

MULTIBLADE FANS

Surpassing in Constructional Detail other Fans of this Type in the same way that CLARAGE STEEL PLATE FANS excel in their class.

CLARAGE FAN COMPANY.
HEATING, VENTILATING & DRYING ENGINEERS.
KALAMAZOO—MICHIGAN—U. S. A.

322

Serves More People in More Ways Than Any Institution of Its Kind in the World

40% more steam with the same amount of coal—J-M Heat Insulation

(Actual Case)

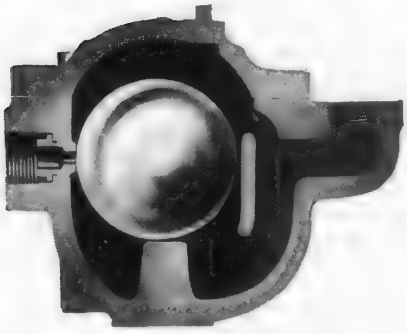
"Does it pay to use an insulation?"

We asked the Chief Engineer of a large plant this question. And his answer was—"at the same time that I installed J-M Heat Insulation throughout this plant, I added apparatus that called for 40% more power. But we are generating no more steam than before the addition to the plant was made."

And this is but one of the many cases where a saving has been remarked. It is but one of the thousands of actual cases where J-M Heat Insulation has helped a plant. Helped with its 21 kinds of insulation, its corps of service men who get together with you to plan the job and who install it for you, if you so desire.

J-M Asbesto-Sponge Felted.—One Style of J-M Heat Insulation

You can clean the J-M Steam Trap in two minutes



Remove the cover, take out the ball and body is accessible for cleaning. J-M Steam Traps seldom need cleaning. They have no stuffing boxes or plug valves to clog with grease or dirt.

But if you should want to clean or inspect a J-M Trap you can do it in two minutes.

There are no levers in the J-M Trap to get out of order and require adjustment. Nothing to break down.

The J-M Steam Trap is fool-proof, trauble-proof, and practically wear-proof. Needs no attention.

Can be used for **any service** where necessary to remove water, air or other gases from steam. Made in all sizes for any pressure or vacuum. Most simple trap made; costs practically nothing to maintain. **Write for special J-M Steam Trap Bulletin.**

H. W. JOHNS-MANVILLE COMPANY

Boston, New York, Chicago, Philadelphia, Cleveland, Pittsburgh, Detroit, St. Louis, Milwaukee, San Francisco

THE CANADIAN H. W. JOHNS-MANVILLE CO., LIMITED,
Toronto, Montreal, Winnipeg, Vancouver.

George P. Jacobs & Co., 272 South Ninth Street, Brooklyn, N. Y.; capital, $100,000; to conduct a heating and plumbing supply business. Incorporators: G. P. Jacobs, R. E. Jacobs and J. H. Wills, all of Brooklyn.

R. F. Morse Co., Providence, R. I., incorporated to manufacture heating boilers. Incorporators: Rudolph P. Morse, Providence; M. L. Miller, Warwick, R. I., and Charles H. McKenna, Barrington, R. I.

Pacific Gas Radiator Co., Los Angeles, Cal.; capital, $25,000. Incorporators: John E. McKeever, Ralph G. Burdick and Walter L. Hallberg.

Orcutt Pipe Hanger Co., Toledo, O.; capital, $15,000. Incorporators: Fordyce J. Orcutt and others. The new company occupies quarters in the Toledo Factories Buildings.

Charles H. Darmstadt, Inc., New York; capital, $20,000; to conduct a heating and plumbing supply business. Incorporators: H. S. Mack, W. R. Grobler and L. F. Darmstadt.

Dubuque Sanitary Mfg. Co., Dubuque, Ia., to conduct a jobbing business in heating and plumbing supplies, as well as to manufacture certain lines of heating and plumbing specialties. The business will be under the management of J. A. Blichmann, formerly secretary of the Kretschmer Mfg. Co. Others associated with the new firm are Frank Meyers, who will have charge of the factory, and J. M. Young, who will manage the sales department.

International Sanitary Mfg. Co., Portland, Me.; capital, $400,000; to manufacture heating and plumbing fixtures. Incorporators: Albert F. Jones, T. L. Croteau and A. B. Farnham, all of Portland.

G. A. Blanchard & Co., Portland, Me.; capital, $10,000; to manufacture heat regulating devices. Incorporators: George A. Blanchard, Arthur Chapman and H. O. Wilbur.

Electric Heating & Mfg. Co., Seattle, Wash.; capital, $75,000. Incorporators: P. F. Apfel, R H. Walker and L. G. Eddy.

Dwyer-Field Agency, St. Paul, Minn.; capital, $25,000; to deal in power plant and heating equipment and contractors' supplies. Incorporators: P. A. Dwyer and D. E. Dwyer, of St. Paul, and M. Field, Jr., of Minneapolis.

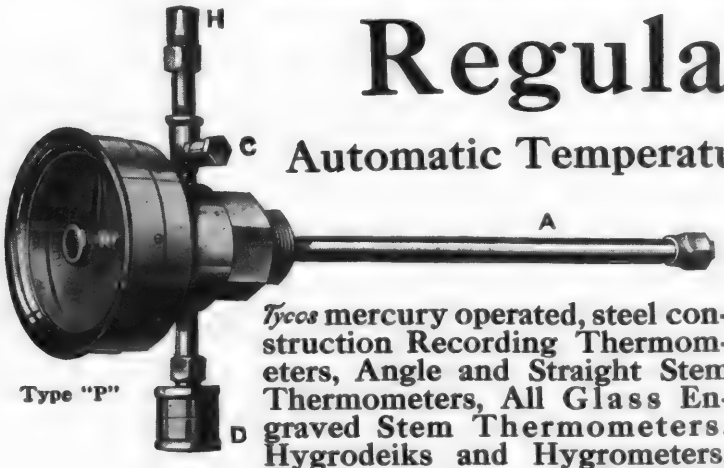
Contracts Awarded.

Chattanooga Heating Co., Chattanooga, Tenn., heating and ventilating Bradley County High School at Cleveland, Tenn.

H&M Thermometers

Regulators

Automatic Temperature and Pressure



Type "P"

Tycos mercury operated, steel construction Recording Thermometers, Angle and Straight Stem Thermometers, All Glass Engraved Stem Thermometers, Hygrodeiks and Hygrometers, Thermo-Electro and Radiation Pyrometers.

The *Tycos* Mercury Operated Recording Thermometer

Mark this: — Every Instrument bearing H & M *Tycos* makes honest claim to supremacy because every manufacturing step is carefully worked out in detail, applications carefully studied.

Put your problem up to us. Our experience will prove very valuable to you. Our service prompt and efficient, suggestions and literature free. Command us.

The H&M Division
Taylor Instrument Companies
Rochester, N.Y.

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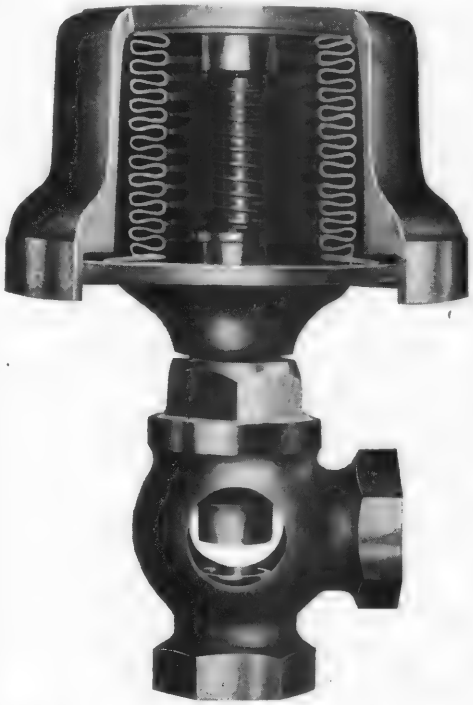


SEAMLESS

SYLPHON

METAL DIAPHRAGM

VALVES

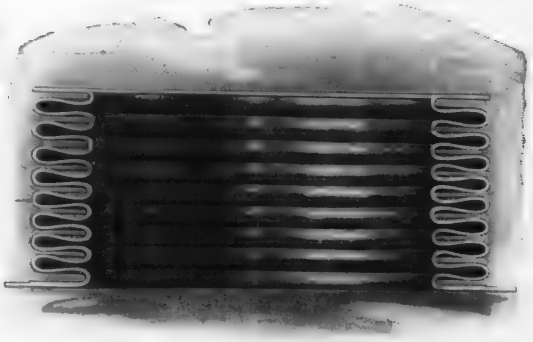
These Valves are without exception the SIMPLEST and most PERFECT metal diaphragm valves ever devised.

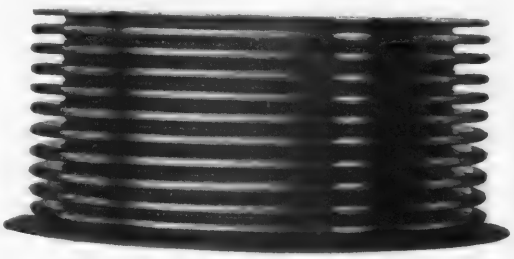
The Diaphragm used in these valves is made from one piece of brass and it is absolutely SEAMLESS, thus insuring against original or developing leaks and giving the longest possible life to the diaphragm.

SEAMLESS SYLPHON VALVES AND DAMPER MOTORS are identified with the

Johnson System of Temperature Regulation

for the automatic control of radiators, mixing dampers, heating stacks, hot water tanks, etc.





Seamless Sylphon Metal Bellows

MANUFACTURED BY

JOHNSON SERVICE CO.

OFFICES

Boston, Mass.
Buffalo, N. Y.
Chicago, Ill.
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Cleveland, Ohio
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Denver, Colo.
Detroit, Mich.
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Kansas City, Mo.
Los Angeles, Cal.
Milwaukee, Wis.
Minneapolis, Minn.
New York, N. Y.
Philadelphia, Pa.
Pittsburgh, Pa.
Portland, Ore.
San Francisco, Cal.
Seattle, Wash.
St. Louis, Mo.

Turner Co., San Francisco, Cal., heating Alameda County Infirmary at Oakland, Cal., for $4,640; the plumbing contract went to the Snook Co., at its bid of $6,640.

Business Chances.

Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, for the following-named work:

Until February 24, 1916, for the construction complete of the U. S. Post Office at Batavia, N. Y. One story and basement, 7,150 sq. ft. ground area.

Until March 7, 1916, for the construction complete, including mechanical equipment, etc., of the U. S. Post Office at South Bethlehem, Pa.

FOR SALE.

One Heavy Construction, Full-Housed Mine Fan, top horizontal discharge, overhung 10-ft. diameter wheel, complete with pedestal, thrust and outboard bearings, and flywheel pulley. Capacity, 70,000 cu. ft. at 350 R.P.M. As good as new and a bargain. Address Aluminum Ore Co., East St. Louis, Mo.

WANTED.

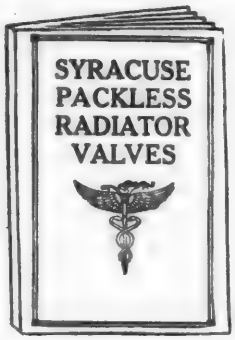
Wanted.—An experienced heating and ventilating engineer who can show good record; to invest from $3,000 to $5,000 in a growing engineering and contracting business, well located. Give full particulars in first letter. Address "Mason," care of HEATING AND VENTILATING MAGAZINE.

FOR SALE.

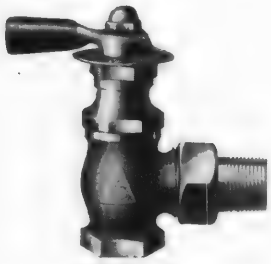
For Sale—One cross-compound Buckeye engine, with high pressure auxiliary cylinder attached. Can be used condensing or non-condensing for steam or hot water heating. The size of this engine is: 18¾-in. diameter high pressure cylinder; diameter low pressure cylinder, 36 in.; stroke, 33 in.; R.P.M., 138; auxiliary cylinder 14½ in. diameter, 33-in. stroke. This engine is direct-connected to a Westinghouse revolving field type, 2,300-volt, 400-K.W., 60-cycle, 2-phase generator.

Also one tandem compound Buckeye engine, 20x36x33, 138 R.P.M., direct-connected to 400-K.W. Westinghouse surface-wound armature type 2-phase, 60-cycle, 2,300-volt generator. Address Iowa Railway & Light Co., Cedar Rapids, Ia.

THREE NEW ONES



Catalogue


Style 37

Style 38

ALL OF THEM DANDIES!

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Built right—To stay tight

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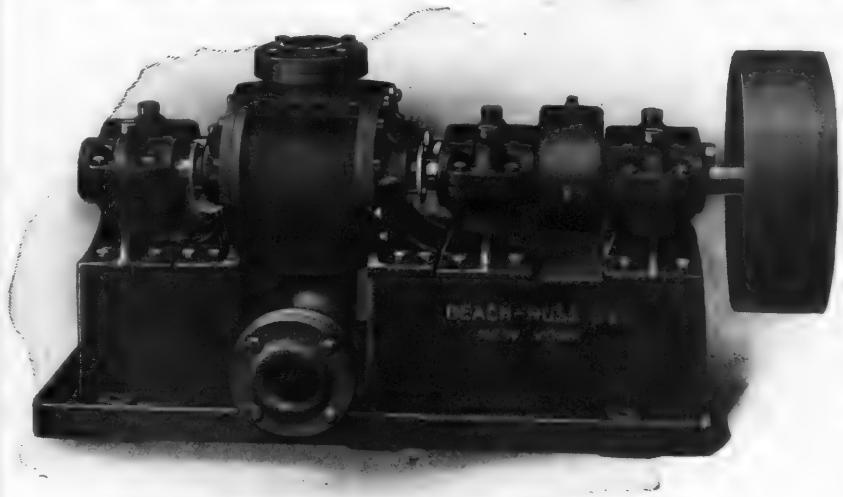

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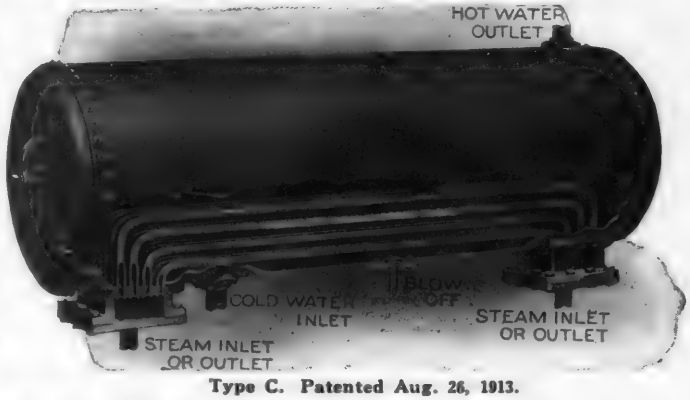

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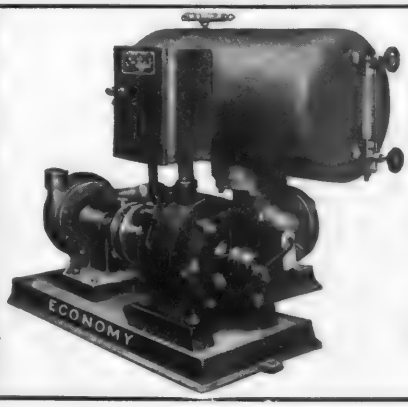

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CONDENSATION PUMP

AND CAST IRON RECEIVER

automatically takes care of the condensation that accumulates in return line of heating system.

Avoids LOWERING BOILER IN PIT—Stimulates circulation.—Saves 25% in fuel consumption.—Small operating cost. Get results from your heating apparatus by using an Economy Pump and Receiver.

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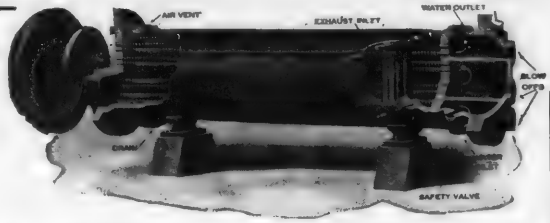

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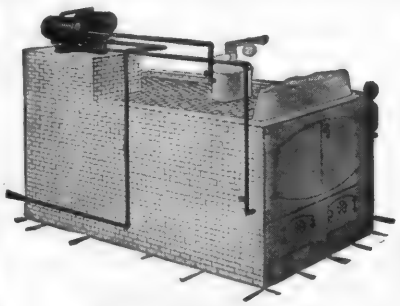

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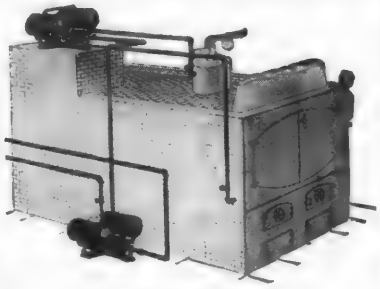
A Guaranteed System of Steam Drainage, Water Lift and Boiler Feeding



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Return Steam Trap

Special Advantages

Two traps combined in one. Double capacity.

Continuous drainage and continuous feed to boiler.

Requires only one-tenth the amount of steam to operate it as compared to a steam pump.

Uses simple brass lined, self cleaning rotary valves.

Returns condensation to the boiler instantly and at high temperature.

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No interference with your present piping system or equipment.

Send for trial trap now.

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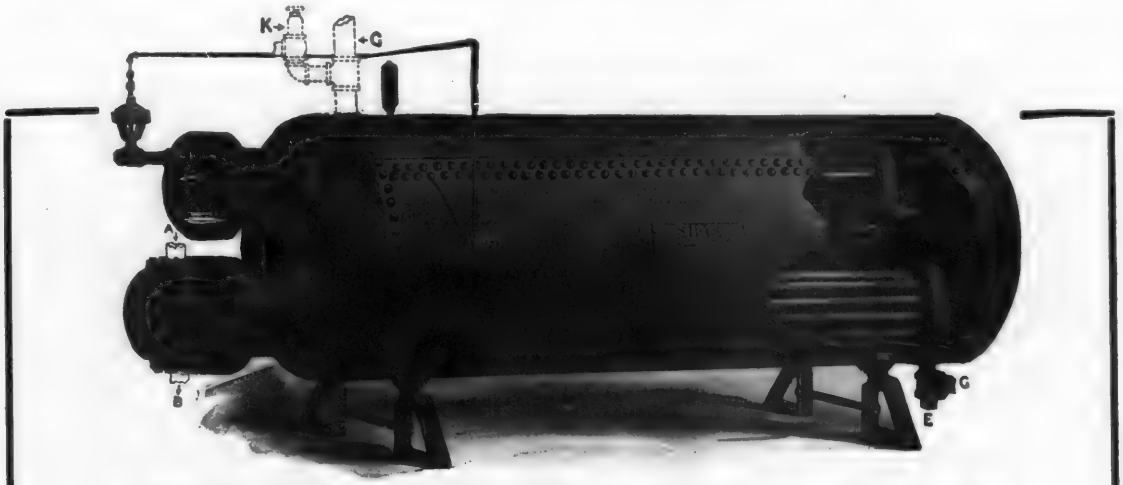

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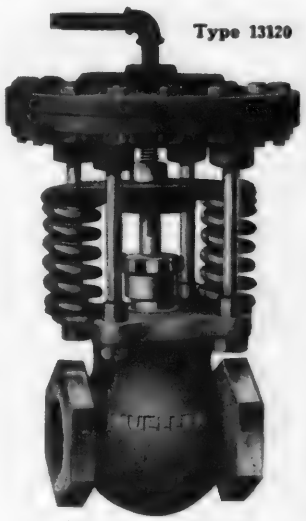

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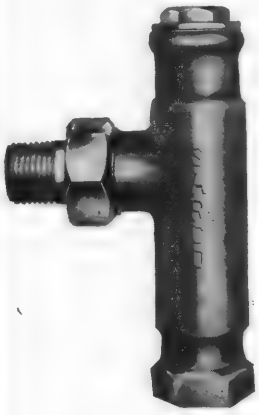

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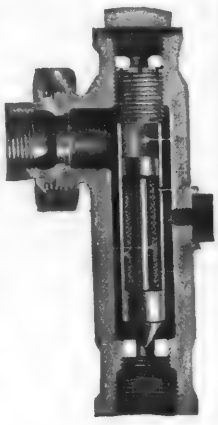

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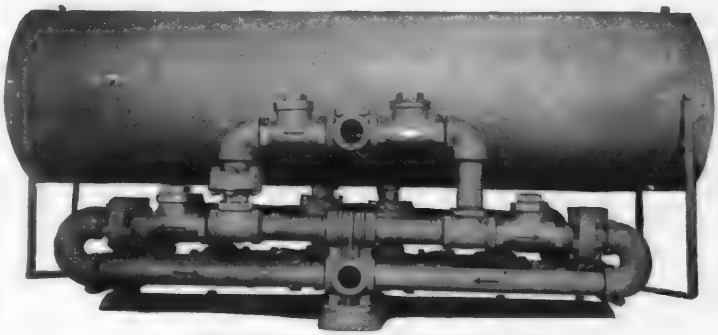
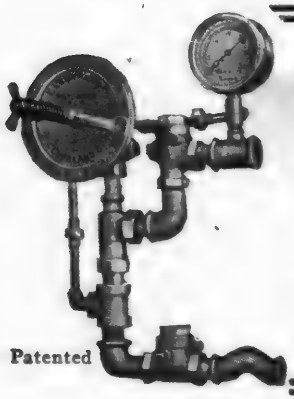


Side Showing Water Inlet and Outlet



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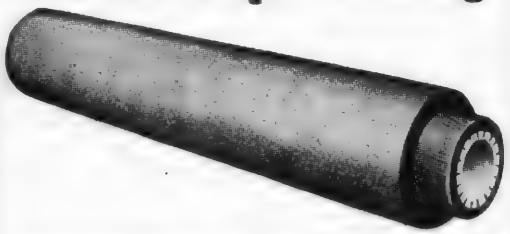

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We also make unlined casing.

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turn with the slightest pressure enabling the wind to create a powerful suction effect. This ventilator does not embody any useless devices or features which are added to most ventilators merely as selling points but which do not constitute actual advantages. The "Sturtevant" is the last word in simplicity.

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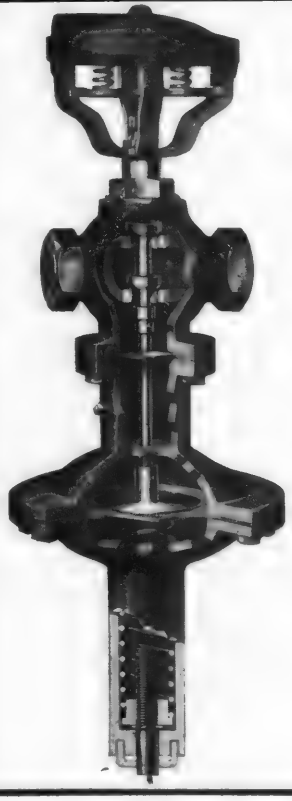
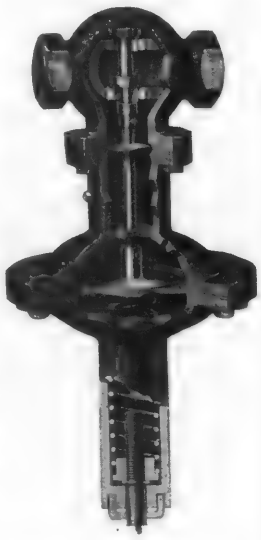


Automatic Pressure and Temperature Control for Central Station Heating



Pressure and temperature control on either steam or hot water when served by a central station saves 20 to 40%. Why waste so much heat?

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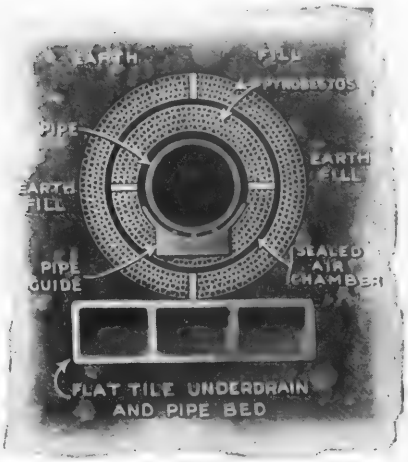

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For piping from central heating or power station to detached buildings of Universities, Asylums, Hospitals, Factories, etc. Also as underground Pipe Conduit for heating private Auto garages direct from House heating system. Lasts longer than Wood; in fact indefinitely. Easily applied and of reasonable cost. Is water repellant,—does not absorb moisture like Magnesia, Infusorial Earth or the loose filling in Tile Conduit systems, all of which materials acting like a wet sponge held against the piping soon rust holes in the piping. We have cases on record where Insulations of the absorbent type have totally destroyed the piping in five years and less after installation, making it necessary to go all over again with the cost of digging trenches, new piping and new Insulation. No material of an absorbent nature should be placed around underground piping. Test all underground Insulations offered you by placing a fragment in a glass of water. If it absorbs water, don't use it.

National Air Cell Covering Co.

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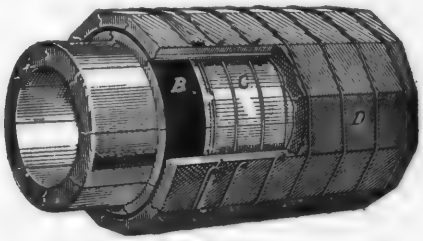

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CYPRESS COVERING

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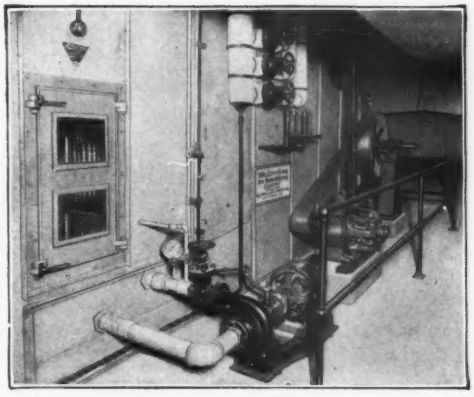

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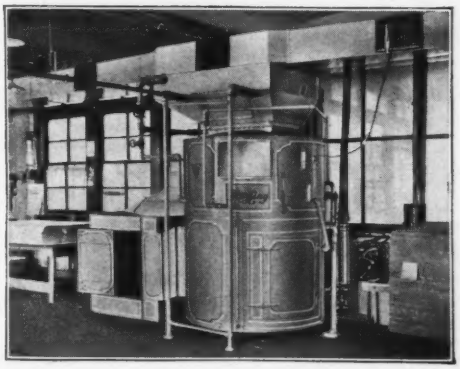

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